# AMERICAN MACHINIST

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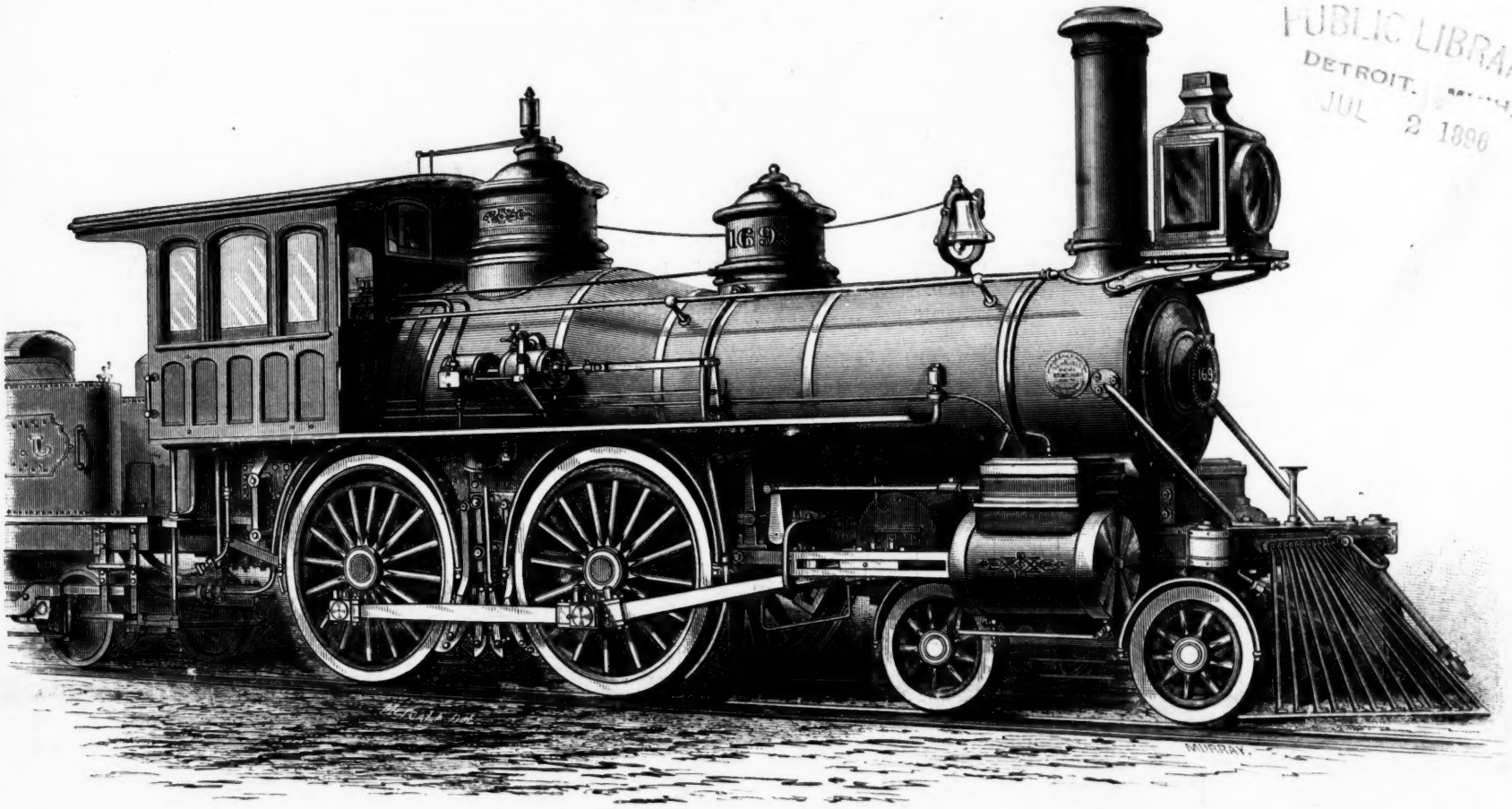



THE SWIFTEST PASSENGER LOCOMOTIVE.—CENTRAL RAILROAD OF NEW JERSEY.

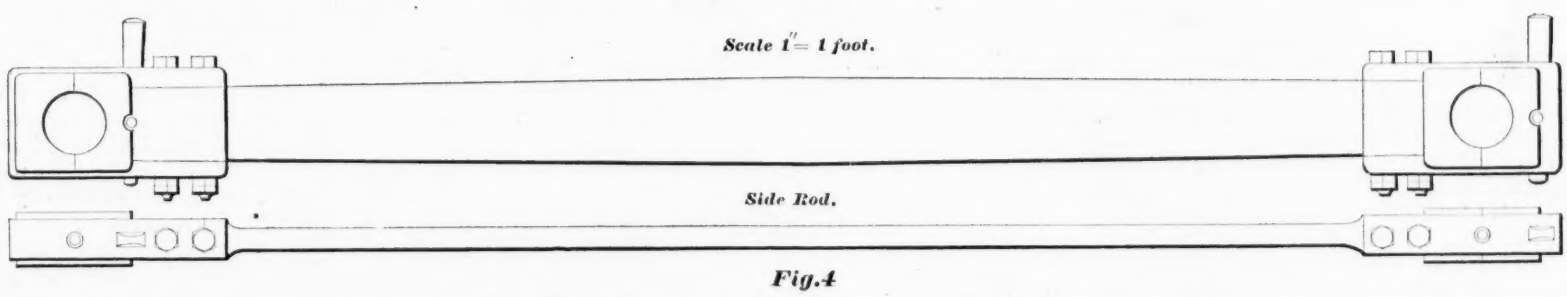



*Fig.4*

## The Swiftest American Locomotive.

With the rapidly increasing passenger traffic upon the railroads in this country has also come the necessity of increased speed, and to day all the railroad companies controlling trunk lines are striving with each other to see which can make the best time with express trains. The Master Mechanics' Association have a standing committee appointed to determine which is the best form of fast passenger locomotive. The locomotive builders are also exercising their brains actively in endeavoring to produce a locomotive that shall combine power, speed and economy—three essential requisites in accomplishing the service desired.

The engraving on this page represents a locomotive lately built by the Baldwin Locomotive Works, of Philadelphia, for the Central Railroad of New Jersey, designed particularly for fast passenger service. This locomotive is considered by its builders to be their best design, combining more desirable features than any other style of locomotive ever built at their works.

Four locomotives of the design here shown (viz., two with 18" × 24" cylinders and two with 19" × 24" cylinders), are now running upon the Central Railroad of N. J., with the object of determining which of the two sizes is the better.

In general appearance the locomotive shown in the engraving resembles the usual style of first-class eight-wheel locomotives, but with with some very important improvements. In order to supply steam to larger cylinders, a larger furnace, more heating surface and greater boiler capacity are required.

In the ordinary passenger locomotive the boiler sets inside the frames, and the necessary water spaces at either side of the fire box greatly reduces the width of the fire box. These water spaces are made as small as is considered safe, in order to get the necessary grate surface. To overcome one evil another is introduced.

Since the introduction of anthracite coal as a fuel upon locomotives, a larger heating surface is required. At first only the best quality was used, but lately coal dust has been successfully burned to some extent.

The true advantages of this, however, are still an open question. Boilers have recently been placed upon the top of the frames, which admits of their being made as wide, or wider, if necessary, than the outside of the frames. This improvement admits of a wider fire box and larger water spaces, but the boiler sets higher, and the depth of the fire box is very much reduced. To overcome these objections, the design shown in Fig 1, on page 2, has been adopted in the class of locomotives here represented. It will be understood by those familiar with the working of locomotives that the hottest part of the fire box is at the front end, and the greater portion of the fuel (anthracite coal) is burned upon the front half of the grate. Fresh coal is placed just within the door, and the jarring of the coal upon the inclined grates *V*, when the locomotive is running, feeds the coal ahead as fast as it is required to supply the fire. It is, therefore, highly necessary that the fire box be made deeper at the front part. To accomplish this, the frames, instead of being made straight upon the top, are inclined from *N* to the middle of the main pedestal jaws *M*, as shown in Fig. 1.

This design makes a very strong job, and allows the grate bars to be placed quite near the bottom of the boiler. Where the boiler is straight upon the bottom, as upon straight frames, in order to get a sufficient incline of the grate bars, a large space is left at the back end of the fire box, between the under side of the grate bars and the bottom of the boiler. It will be observed that this space in the engraving is quite small. The boiler is strongly bolted to the cylinder saddle, which is formed of two pieces, each cylinder being cast solid with the saddle, and bolted together at the center. The back part of the boiler is strongly supported by four links *H*, which allow a free expansion without springing the frame. Particular attention is directed to the ingenious method of arranging the springs and equalizing bars.

The equalizing bars *I*, also the back springs *K*, are located between the frames, in spaces which are in most engines unoccupied, while the equalizers *J*, placed upon top of the driving boxes occupy the place of saddles. The main springs *L*, are located in the usual position, over the main driving boxes, while all the springs are easy of access.

The ash pan is arranged as shown at *S T*, having slides at the bottom for the removal of ashes and clinkers.

The tail end of the frame is made in a very substantial manner for the drawhead, as shown at *U*, the wear iron upon the tank being represented by *W*.

This arrangement is better shown in Fig. 3, which represents a cross half section through line *A B*, and end view of locomotive. The tail piece is shown at *P*, and the lower brace for drawhead at *O*, being strongly bolted together.

There are three solid grate bars *N*, which may be partly or wholly withdrawn, in knocking out or cleaning the fire. This may also be seen in Fig. 2, which shows a cross half-section, through line *C D* of Fig. 1. All except the three solid grates, are hollow water tubes, as shown at *M*, Fig. 2. A cross section of back spring is shown at *C*.

The circulation of water about the fire box is excellent, on account of the enlargement at the top, shown at *A*, in Fig. 3. Generally, the space at *A* is the same as at *B*, which does not give as good a circulation, because the globules of steam in rising toward the surface of the water require more space as they expand.

The crown sheet is strongly supported by bars shown at *J*, the ends supported by the castings *K*, which rest upon the edges of the crown and side sheets.

The running boards *E* are wholly of sheet iron, with edges formed of T iron, as shown at *G*. Within the cab *F* the running boards are covered with wood.

This locomotive is furnished with a steam reverse, operated by only one lever by a single motion, which will be illustrated and described in detail, in a future issue of the AMERICAN MACHINIST.

The connections with the lifting shaft are shown at *P O*, in Fig. 1. In case any of the pins should work out of the link motion, the front ends of the eccentric rods are prevented from falling upon the track by a guard *Q*, of round iron, extending across below the frames. The side rods are made large at the center, as shown in Fig. 4, and will be easily understood from the detailed dimensions.

Through the kindness of Wm. Woodcock, Master Mechanic of the Central Railroad of New Jersey, we made a trip on this locomotive (No. 169), and were very much pleased with the ease with which the engine performed its work.

The train usually consists of five cars, viz., one baggage, one express, one Pullman drawing-room coach and two ordinary passenger coaches. With this train, and notwithstanding the fact that the smoke stack is well enclosed within the smoke box, to prevent throwing fire, plenty of steam is generated at all parts of the road. The distance from Jersey City to Bound Brook is 32 miles, and the regular schedule time between stations is 37 minutes. This distance has been run by No. 169 in 33 minutes. *Three miles upon the route have been run in* 2 *minutes and* 24½ *seconds*—the same distance frequently covered in 2½ minutes. The *quickest mile* ever run by this locomotive was in 45 *seconds*—timed between mile posts with a stop watch.

This is the best railroad time we ever heard of. W. C. Aten, the engineer, says: "She is the boss, and behaves as if she liked an opportunity to make up a little lost time." We are informed that with this style of locomotive very little time is ever lost upon the road.

We append the following dimensions of details:

| | |
|---|---|
| Gauge of road | 4′ 8½″ |
| Boiler material, Otis steel; thickness | ⅜″ |
| Diameter of shell | 52″ |
| Style.—Wagon top. | |
| Fire door diameter | 16″ |
| Dome over fire box, diameter | 32″ |
| Fire box sides, corrugated, length | 125⅛″ |
| Width, " " " | 43⅛″ |
| Depth, front, " " | 51¾″ |
| " back, " " | 42½″ |
| Material, Otis steel, crown sheet, thickness | ½″ |
| Tube sheet, thickness | ½″ |
| Sides, " " | ¼″ |
| Back, " " | 5/16″ |
| Water space, back, thickness | 4″ |
| " " front, " | 3″ |
| " " sides, " | 3″ |
| Crown bars, " " | 5″ x ¾″ |
| " " placed above crown sheet | ½″ |
| " " bolts ⅞″, screwed through sheet with nut below. | |
| Combustion chamber | 5″ |
| Tubes, iron, No. 12, wire gauge. | |
| " ends swaged for copper rings at fire box ends. | |
| Tubes, number | 200 |
| " diameter | 2″ |
| " length | 11′ 5⅞″ |
| Dry pipe, wrought iron, diameter | 8″ |
| Grate, water tubes, " | 2¼″ |
| Grate, area in square feet | 38 |
| Heating surface in fire box | 145 |
| " " " tubes | 1175 |
| " " " total | 1,320 |
| Steam pressure per square inch | 140 lbs. |
| Wheel base rigid, driving wheels | 7′ 6″ |
| " " " total | 21′ 8″ |
| Weight of locomotive in working order, | 93,000 lbs. |
| Cylinders, diameter | 18″ |
| " stroke | 24″ |
| Steam ports, length | 16″ |
| " " width | 1⅝″ |
| Exhaust " " | 3″ |
| Bridges " " | 1⅝″ |
| Valve, Allen's. | |
| " travel | 5½″ |
| " lap outside | ¾″ |
| " lap inside | 1/32″ |
| Lead | None |
| Eccentrics, throw | 5″ |
| Exhaust, nozzles, 3½″ diameter, double. | |
| Cross head, wings, phosphor bronze. | |
| Rod, brasses, phosphor bronze. | |
| Piston rods, steel. | |
| Packing rings, brass, with springs and studs. | |
| Heads and followers, cast steel. | |
| Connecting rods, Otis steel. | |
| Side rods, taper, 4½″ at ends and 5½″ at center. | |
| Thickness | 1⅝″ |
| Driving wheels, diameter | 68″ |
| Solid spokes and rims. | |
| Standard steel tires. | |
| Driving axles, Otis steel. | |
| " " journals, diameter | 7½″ |
| " " " length | 8½″ |
| Brake, Westinghouse Automatic. | |
| Smoke Stack, straight, company's style; height above rail | 14′ 10″ |
| Opening | 16¾″ |
| No pumps, two injectors instead. | |
| Truck, 4-wheeled, swing bolster. | |
| Pedestals faced with steel plates. | |
| Diameter of wheels | 32″ |
| Journals, diameter | 5½″ |
| " length | 8″ |
| Tires, standard steel. | |
| Tender, 8-wheeled. | |
| Tender Frame, iron. | |
| Capacity | 3,000 gals. |
| Made of Otis' steel, top, bottom, and sides No. 4, and outside No. 8. wire gauge. | |
| Wheels, diameter | 30″ |
| Plate, Washburn, steel tired. | |
| Journals, diameter | 5″ |
| " length | 8″ |
| All truck axles, both on Engine and Tender, made of Otis' steel. | |

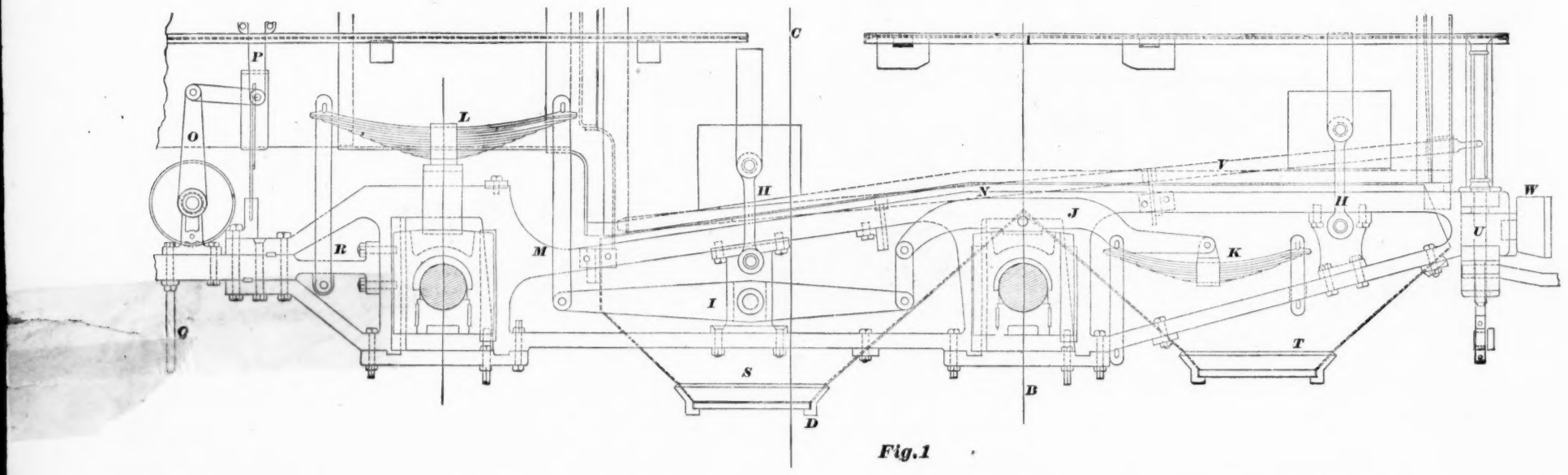



*Fig.1*

In our description, last week, of a standard horizontal boiler, we were somehow made to refer to the "concave system of riveting." We do not doubt that, in the main, our readers appreciated the blunder, as the most of them are sufficiently acquainted with the processes of boiler making, not to take readily to something quite so contradictory in terms as concave riveting, while for similar reasons, they do know something of concave calking, which was what we intended to have said.

Recent statistics show that the average machinist in the State of New Jersey saves $124.26 yearly, the average saving of all workingmen being $43.26.

## Building and Firing Large Ovens.

BY THOMAS D. WEST.

There is nothing in a foundry that is ordinarily so illy constructed, and with which so much fault is found as the ovens for drying moulds and large cores. Ask any moulder who has traveled considerably how many ovens he knows of that give good satisfaction, and it will tax his memory to tell of more than two or three, and then if they are not located so as to be in the way, or take up the best portion of the shop, it will be a wonder.

When building a foundry, the locating of the oven should be attended to by a thoroughly practical man, and is a matter that should receive much thought and attention, as there are few shops in which they can be built on the same general plan. Ovens should be built where they will be out of the way of doors, gangways and green sand floors, and, if possible, should be in that section of the shop where the loam and dry sand work can be done to the best advantage. In some shops ovens are placed so that the track has to be curved in order to run the carriage under the sweep of the crane. This is a very bad plan, as the car, when heavily loaded, moves hard on a curve.

When the ground room will allow it, and the shop room is small, it is best to have the ovens built outside the shop, having the entrance even with the inside wall.

In building ovens it is also important to know and provide for the class of work intended to be made or dried, as some work will not stand to be dried fast. Such work as large cores, cylinders, gears, or any fine dry sand or loam moulds, should be dried with a slow even fire, especially if the moulds are to be blacked dry. Such moulds as rolls, spindles, propeller wheels, or other coarse work, will usually stand a hot fire. There is nothing so bad to handle as burnt moulds or cores, for which the poor night watchman seldom escapes blame.

Mixtures of dry or core sand, having plenty of loam and sharp sand in them, will stand a hotter fire without being burnt than sand having flour, meal or much moulding sand mixed with it.

For large cores that must be dried quickly and without cracking or being burnt, the less flour and the more clay wash used for mixing the sand the better.

For fuel in firing up ovens, coke is the best, and should be used more than it is. Hard coal is good and makes a hot fire, but its extra expense is an objection. It is a good plan to mix a little in the fire with the coke when a very hot fire is wanted. Most ovens are fired with soft slack coal, on account of its cheapness. It is good for drying rough work, but a serious objection is the soot and dirt it makes. Look at a moulder after he has been inside a cylinder, brushing or cleaning the mould, and he is so black and dirty that you would hardly know him. The question is, can a man in such a condition feel like doing a clean, neat, mechanical job? A soft coal fire is not a steady fire, and it requires close attention to keep it going, and will burn moulds and cores very often. Should moulds or cores require to be blacked dry, with this kind of firing, it is almost impossible to do it, and make a reliable, clean mould, on account of the oily surface the smoke and soot leaves on the face. With a coke fire, moulds or cores can be blacked dry, in a neat, clean manner, being almost as clean when they come out as when they go into the oven. It makes a steady fire that needs very little watching; and with a fire basket, like the one shown in the cut, you need not bother the night watchman to do any firing during the night. Should your mould or core be burnt, you can blame no one but the man who fixed the fire before going home.

If you want a good hot fire, fill up your basket full of medium sized coke, and leave the drafts open.

Should you want a slow fire the first part of the night, so as not to blister the green blacking, or crack open the cores, leave the drafts partially closed and have the watchman open them in an hour or to.

Should you want a slow fire all night, only have the basket half filled, and keep the drafts all closed. When the fire is renewed in the morning, shake up the grate bars and run a bar between the upright bars, to loosen up the fire and get the clinkers out, and then put on more coke, and your fire will run all right again till night. A basket of the dimensions shown, is large enough to heat an oven 10 feet wide, 18 feet long, and 8 feet high. For very large ovens, it would be better to have two baskets, one on each side of the oven, and for all sized ovens to have extensions built, as shown attached to the revolv-

ing oven (in my article in AMERICAN MACHINIST of December 31), and to have the fire basket placed in the extension. When the fireplaces are built inside the oven, there is a large space to be heated that cannot be used to any advantage, which causes a loss of fuel.

In arranging for the fire basket, two bearing bars are built into the brick walls to support the grate bars, and the bottom is bedded on a solid brick foundation, the front of which is left open, so as to admit a draft and to get out the ashes. The back and sides are closed up, so no cold air can get into the oven. What air does get in is heated, as it has to pass through the fire, making an increased draft.

The top basket frame is supported by the four corner uprights, which have projecting pieces cast on them for this purpose. Should any of the upright bars get burnt out, they can be taken out and new ones put in.

The inside, which is subjected to the direct heat from the fire, should be built of fire-brick, and the whole brick-work of the extension should be well stayed with binders and bolts, so as to keep the heat from cracking it.

This plan of a coke basket and fire-place is by one I constructed not long ago, and it gives the best of satisfaction. Attached to the fire basket is a fire front not shown. The lug *B* is one of four that are cast on the face of the basket frames for bolting the front to. The purpose is to make the fire-place all air-tight above the grate bars. The front has two doors that can be opened for shoveling in coke. These doors open opposite each space in the basket, so as to get at the fire. A slide or damper is made to close the openings, so that, if the thin sheet iron outside doors *X X* were opened, you could see no fire. These doors do not come down within 2″ or 3″ of the bottom, the space being to admit air. When the draft is to be closed air-tight, a loose plate is used to close the bottom opening, and sand shoveled against the joints.

The most essential point in constructing ovens is to have good draft arrangements. In most ovens there should be a top and bottom flue opening into the chimney, with dampers to open and close them. It is a good thing to have a cover placed over the top of the chimney hole, and made to open and shut; and, when you want to retain the heat, and keep the oven from getting cold, shut down the cover, and it will save two or more hours' firing when the oven is not wanted for a day or so.

The styles of fireplaces used are various, but the two shown are the best that I know of. The one above described is the best for drying a fine class of work that requires an even, steady fire; but, where you want a strong heat for moulds that will stand to be dried quickly, the under flue firing oven, as shown, will do the best work. In this style of a fireplace the heat comes up from the bottom through the holes made in cast iron plates. The plates are made 1¼″ thick and in sections, so that they can be lifted by hand to clean out the flues. The oven is shown having the rear end open; also, one side of the firing pit, and the arched brick covering over the fireplace, by which means the construction of the two flues that run the whole length of the oven can be seen.

These flues should be built with fire brick, and it is best to have about six feet of the covering of the end connected with the fire-place arched over with fire bricks instead of the perforated iron plates, so as to prevent the direct flame from the fire from getting into the oven, or burning out the plates. I have seen strong fires make these plates at the farthest end from the fire nearly red-hot.

The cost of firing such an oven is expensive, as one will burn nearly half a ton of soft lump coal in one night. The fire-place is built below the level of the shop floor, and steps are needed to get down to attend to the fire. Should this pit be built outside the shop, it should be constructed so as to keep the rain or water from getting into the pit.

The size of this fireplace is enough to heat a larger oven than the one shown. This oven shows a flat top, supported by railroad bars, with sheet-iron plates on top of them, and a course of bricks over the whole to keep the heat from escaping. This style of covering I prefer to an arched brick top, with which there is a large space to be heated that can hardly ever be used.

This blue oven would work well with a coke basket, instead of the coal fire-place, but would not make so hot an oven, or dry as quickly. Ovens could be made having a basket-coke fire, as shown, attached to the revolving core oven, and the under-flue arrangement also, with a coke fire. To make a very hot oven in the core, both fires could be used, and for slow drying, either one or the other. With this combination, any class of work can be properly dried.

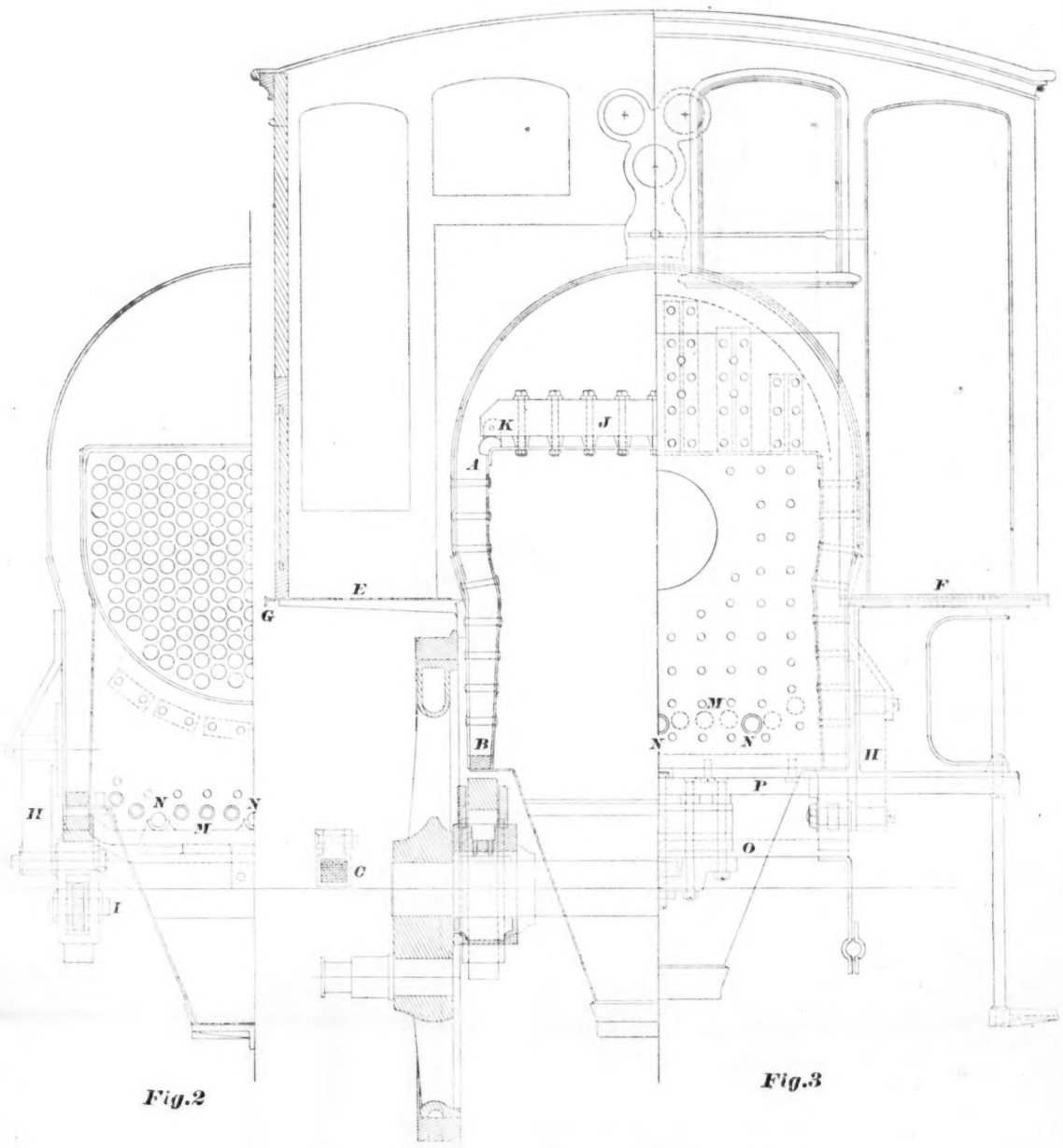
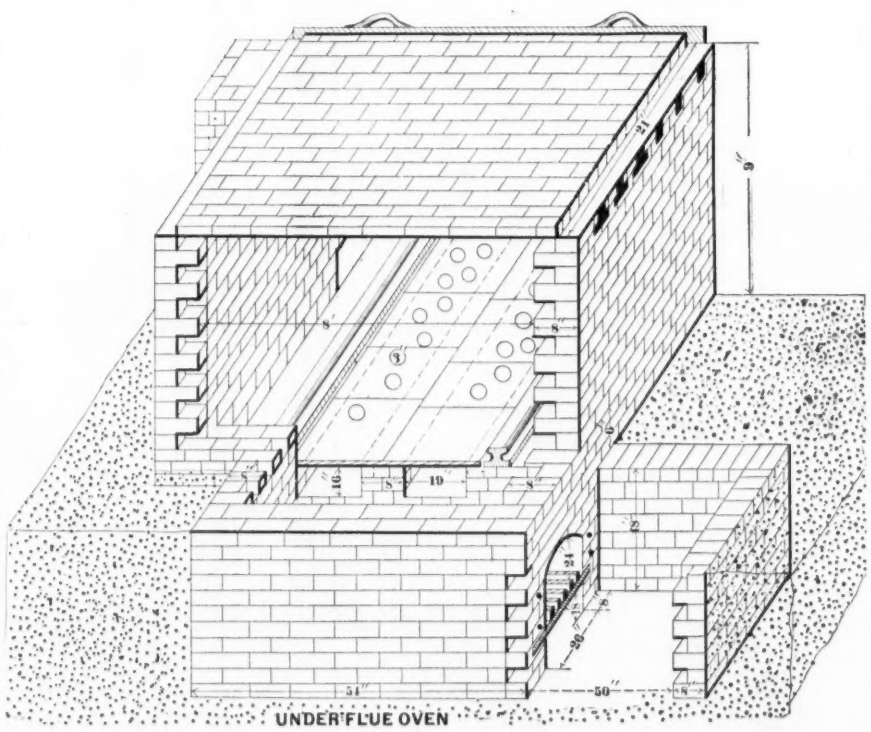
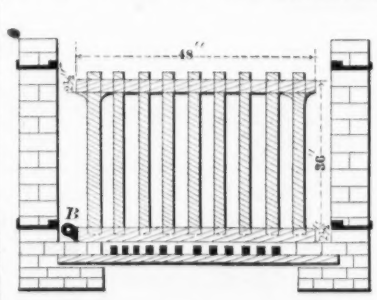


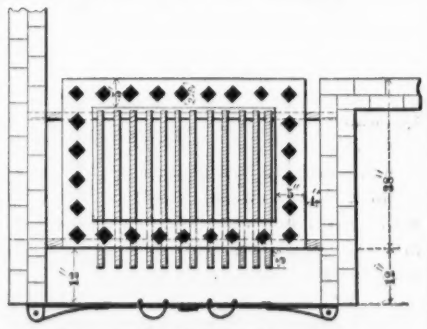

*Fig.2* *Fig.3*

HALF SECTION OF LOCOMOTIVE BOILER WITH REAR VIEW.—See page 1.




ELEVATION OF A COKE FIRE BASKET



PLAN OF BASKET

## Coating Cotton with Silk.

Some time ago there was announced from France a complete revolution in the silk trade. Just as base metals can be coated with a thin layer of gold or silver, so it was said, the discovery had been made to apply a coating of silk to vegetable fibers. Thus a great saving of the raw material would have been effected, and silk goods could be produced very cheaply. It does not seem, however, that this very difficult problem has been already solved, though many attempts have been made and some real progress has been effected. The result of experiments is that about eighteen months ago an inventor maintained that he had succeeded in producing silken tissues with a saving of 60 per cent. Cotton yarns were given him, which he converted in a few hours into splendid silk yarns. Unfortunately for the too clever inventor it was perceived one day, before the purchase of his patent was completed, that the whole was a simple fraud. The cotton yarns given him had six threads; the silk which he gave back had only three!

We have heretofore alluded to a similar fraud which had been accomplished in this country, much to the disgust of a couple of now retired Paterson silk manufacturers. As regards coating cotton, &c., with silk, it is a fact that silk is soluble in a number of chemical agents. It dissolves completely in the chloride of zinc; also in acetic acid at 302 deg. F., and in ammonia at 320 deg. F. Imbs even asserts that he has dissolved both silk and wool in pure water at 374 deg. F. We can, therefore, readily understand that linen threads might be permanently coated with a layer of silk, if steeped in such solutions at a certain pressure and temperature, and then submitted to a process like wire drawing. The thing has been tried, but only with relative success. Silk, when dissolved, loses its lustre, and the difficulty is to restore it after being deposited on cotton or linen.—*Industrial Record.*

It is said that electric lighting is successfully employed on more than 60 Mississippi steamers.

## The Bulkley Injector-Condenser.

Until within a few years the only practical means employed to p oduce a vacuum in th cylinder of a steam engine was by the use of an air pump and condenser. By this means it is ev.dent that no useful effect is produced by the velocity with which the exhaust steam rushes into the condenser, it simply being brought to a state of rest in the condenser, where it is condensed by the incoming water of condensation; being either brought into intimate contact with it, as in the ordinary jet condenser, or into contact with surfaces constantly cooled by the circulation of cold water, as in the surface condenser. In either case the air pump removes the water resulting from the condensation of steam, together with the vapor and any air that may find its way into the condenser; in the jet condenser, the air pump being large enough to remove the water of condensation, as well as the condensed water, and in the surface condenser an extra or circulating pump being used to circulate the water over the cooling surface.

Notwithstanding the cost of power required to operate the air pump, or the air and circulating pumps, and the additional machinery required to be kept in repair, the great advantage derived from removing a pressure equal to about 13 pounds to the square inch from the *res st ng* side of the piston—a pressure frequently equal to one-third of the mean effective pressure—amounts to a gain in fuel economy so considerable, that in the instance of large engines the air pump and condenser have been almost universally employed.

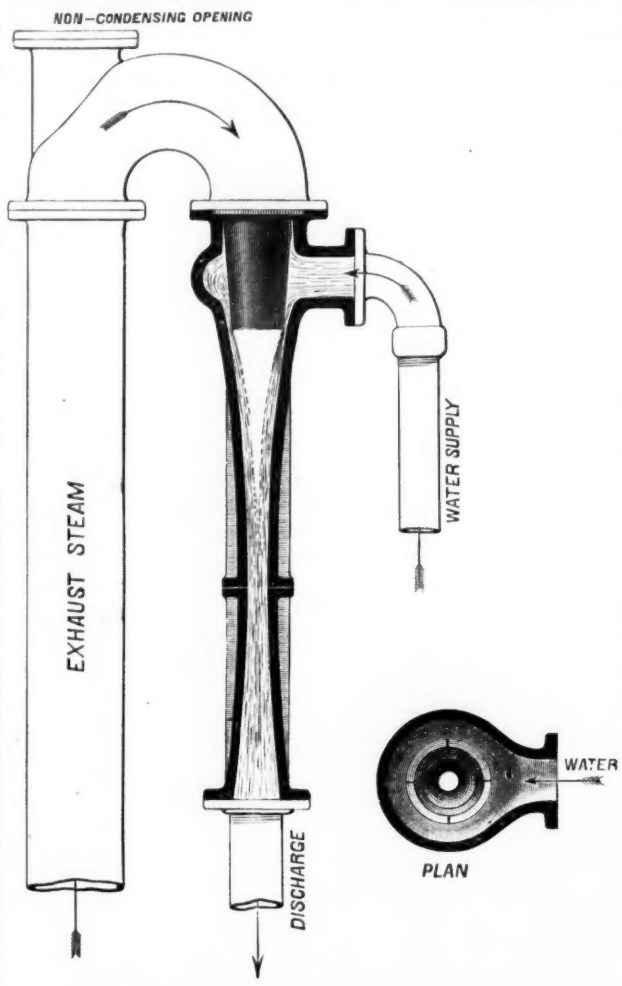
More recently another form of condenser has come into extended use, which differs from this in that no air pump is required, the velocity of the exhaust steam being utilized to do away with the necessity for it, and for which it is claimed, that by its use the power required to drive a large air pump is saved, or at least that less than one-quarter of this power will be required; also, that it is much simpler in its general arrangement, requiring no skilled attention to operate, and producing a better and more reliable vacuum.

The accompanying engravings represent one of these condensers, a large number of which have been applied within the past few years, and with the operation of which we speak from personal observation.

By reference to the sectional view and partial plan, the condenser is seen to consist of two conoidal nozzles connected together by a neck of uniform diameter. These nozzles and their connecting neck are made quite smooth, so as in no way to break the current of water, or prevent its proper formation, as hereafter described. The upper part of one of these nozzles is extended, and enlarged to allow of the introduction of the nozzle through which the exhaust steam passes to the condenser, and also to allow of the introduction of the condensing water, as clearly shown. At the top of the elbow connecting the exhaust pipe with the condenser is an outlook, or branch, directly in line with the straight part of the exhaust pipe, which leads to the atmosphere, and is shown covered by a flange.

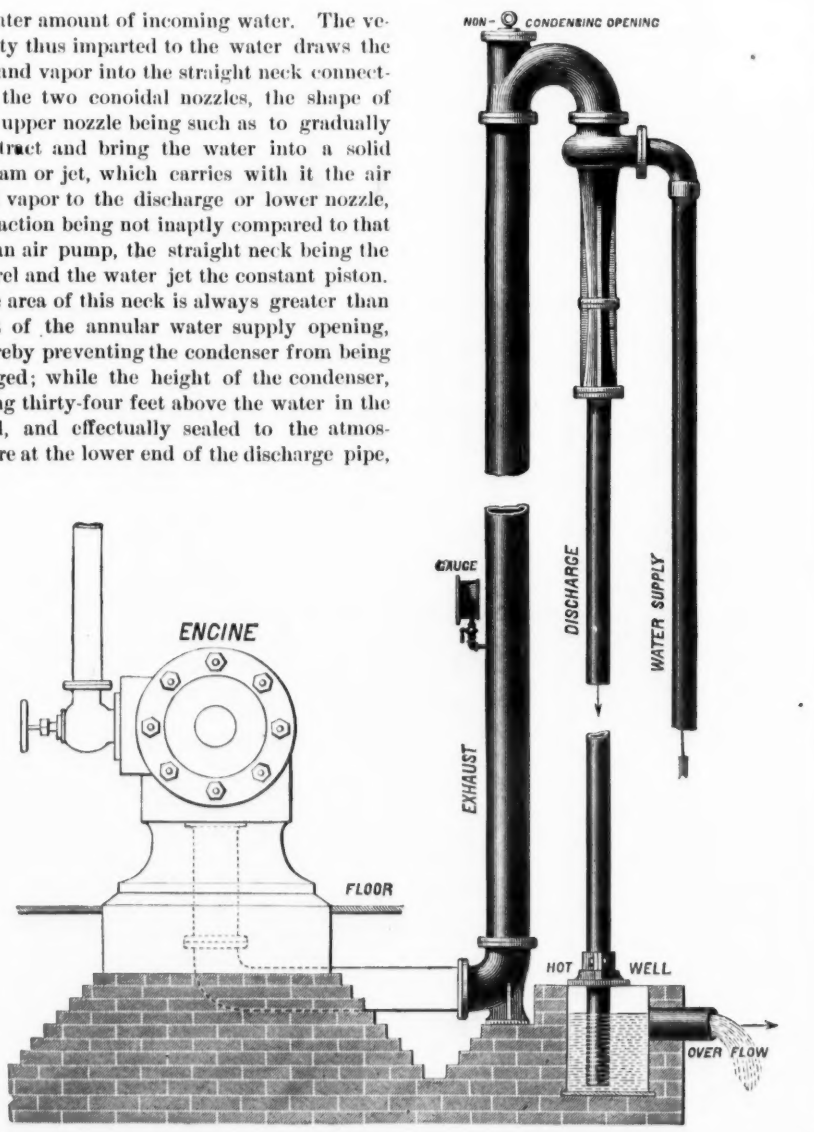
By referring to the engraving representing the condenser, as attached to a horizontal steam engine, its operation may be further explained. It will be seen that the exhaust pipe is in a vertical position, and it is of such a height as to bring the condenser not less than thirty-four feet above the hot well. From the bottom of the condenser the discharge pipe leads into the hot well, the overflow from which should be at such a height as to keep the bottom of the pipe at all times sealed to the atmospheric pressure, by the water in the well.

The exhaust steam entering the condenser (as shown by the direction of the arrow in sectional view) is met by the condensing water, which enters the space around the exhaust nozzle, which it entirely surrounds, and passes from there into the condenser through a narrow annular opening, thereby forming a hollow cone of water, into which the exhaust steam rushes, is condensed, and imparts its velocity in a modified ratio to the




SECTIONAL VIEW OF INJECTOR-CONDENSER.

greater amount of incoming water. The velocity thus imparted to the water draws the air and vapor into the straight neck connecting the two conoidal nozzles, the shape of the upper nozzle being such as to gradually contract and bring the water into a solid stream or jet, which carries with it the air and vapor to the discharge or lower nozzle, the action being not inaptly compared to that of an air pump, the straight neck being the barrel and the water jet the constant piston. The area of this neck is always greater than that of the annular water supply opening, thereby preventing the condenser from being gorged; while the height of the condenser, being thirty-four feet above the water in the well, and effectually sealed to the atmosphere at the lower end of the discharge pipe, the water cannot find its way back into the cylinder.




THE CONDENSER CONNECTED WITH HORIZONTAL ENGINE.

When properly arranged and operated, this condenser continuously delivers to the hot well the condensed and condensing water, together with any air that may find its way into the condenser, the result being a steady and constant vacuum.

The water from the hot well may be used for any purpose, where water of about 100° temperature is required.

Where there is a natural head of water, it may be used to supply the condenser. It is not necessary that this head be the full height of the condenser, as with a head of 15 feet, the condenser will raise its own water after the vacuum is formed, which may be done from a reservoir or tank, or by the means of a pump.

When there is a head of 19 feet, a sufficient vacuum may be formed by the use of the starting valve (shown in the cut representing the condenser connected with a vertical engine) to raise the water to the condenser, after which a perfect vacuum will be formed without further assistance.

Where the water is to be raised the entire distance, a pump of some kind must be used, but after the vacuum is formed the work on the pump will be light, since the water will be lifted about 25 feet of the distance by atmospheric pressure. If a steam pump is used the exhaust can be connected with the condenser, thereby reducing the steam required to operate it, to a trifling quantity.

If it is desirable at any time to run the engine non-condensing, it is only necessary to remove the flange previously referred to, or a valve may be used in place of the flange, if desirable.

In the cut of the condenser attached to a vertical engine, is shown the manner of connecting the pipes when it is desirable to get the hot well below the engine foundation. It will be seen that these condensers may be attached to high-speed equally as well as to low-speed engines, and that when attached, there are no parts in motion to break down, wear out, or to consume power. In converting non-condensing into condensing engines, no provision has to be made for driving an air-pump, and the hot well can be located in the most convenient place.

In addition to their use in connection with a steam engine or steam pump, they may be connected with the receiver or vapor pipe of vacuum pans, oil stills, etc., or be used as an exhauster on stills or kettles, and will remove and condense noxious or unpleasant vapors.

They are manufactured by Henry W. Bulkley, office 149 Broadway, New York.

## Plumbago and Fat for Lubricating.

In an article on "The Rivals of Lubricating Oils," the *Industrial World* gives the following, among other facts, about plumbago:

The lubricant acts by filling up the inequalities, and forming a surface of its own slippery self, upon which the bearings work. It is also a very effective lubricant for metals, and would probably supersede all the oils if it could be as easily applied, but this is by no means the case. We cannot pour it or drop it so that it may run just to where it is required, as we do with oil. Many contrivances have been made, and some patented, for overcoming the difficulty. They are mostly attempts to incorporate the plumbago with one or the other of the bearings, so that plugs of plumbago shall fill up holes or cavities, and thus wear away with the metal. But the success of these is doubtful when applied in ordinary cases.

In other cases the plumbago is melted into fat, and the compound is applied hot. This is largely and very advantageously done where the bearings themselves are hot enough to melt tallow. Such is the case with the necks of the "rolls" through which red-hot iron passes when being rolled into the form of plates, sheets, bars, wires, etc. The lubricant thus made is known in the iron works as "hot-neck grease," and is made by recovering the fat from the waste soap-water of cloth works, which fat is usually black in itself, and, therefore, not at all soiled by plumbago. The man who first practically succeeded in this art of recovering the waste fat by means of acids has made a handsome fortune by his shrewdness. The scientific inventor of the process failed on account of the cost of carrying so much liquid to the works, and was on the brink of ruin when a shrewd man of business learned the nature of his difficulty, and overcame it by the simple device of contracting for the waste liquor at the cloth works, with a condition that he should be allowed to set up a tank there and apply his acid. He did so, and thus only had to skim off the fat and carry that away, instead of carrying all the waste water. Like Mahomet, who went to the mountain when the mountain refused to come to Mahomet, he went to the soapsuds when the soapsuds refused to come to him at a paying cost.

On the 1st of January next the letting of convict labor by contract in the penal institutions of California will cease. When Gov. Perkins assumed the duties of the executive office, he applied himself to the task of discovering or suggesting proper employment for the convicts which should not work an injustice to the free skilled laborer. His conclusions were embodied in a message to the Legislature, and the latter at once made appropriations for the erection of buildings and the purchase of machinery necessary to carry out the new plans. The buildings are now up and the machinery in, and on Jan. 1 the Warden of St. Quentin will put 1,500 prisoners to work on the manufacture of jute bagging and bags, of which there is an immense consumption on the Pacific coast. Millions of these bags are imported annually, and only an insignificant number are manufactured, principally by Chinese labor. Thus, under Gov. Perkins' plan, this industry in San Quentin will compete with no free white labor, while it will supply an article in constant and large demand.—*New York Sun.*

The feat of picking cotton in the morning and having a suit of clothes by night has been surpassed. "The corn was shelled in the morning," said an exhibitor, "and the man was drunk before dark."—*Atlanta Constitution.*

The time tables of the Boston and Albany Railroad contain this notice, which is like the note in the old Thomas Almanac, "Calculated for the latitude of Boston, but equally well fitted for other parts of the United States:"

INCIVILITY.

Passengers are respectfully requested to report to the General Superintendent any instance of incivility on the part of employes of this company. While it is the aim of the company to redress just grievances, it is suggested that courtesy is equally commendable whether practiced by the railroad employe or the passenger.

A spruce young man who graduated from a certain institution last year, issues the following card:

MECHANICAL EXPERT WORK.—Examining and testing machinery—especially steam and other engines.

PATENT EXPERT WORK.—Searches; examining machinery and experimenting; complicated drawing, including mechanical perspective.

SPECIAL QUALIFICATIONS.—For writing patent specifications; comparing infringing patents; procuring and giving technical evidence in court.

INVENTOR EXPERT WORK.—In this new and original profession I propose to aid the inventor in developing and perfecting inventions. Besides special natural capacity, I have had a course of education and training especially intended to qualify me for such work.

CHARACTER OF WORK.—Inventing; designing and drawing; all kinds of patent work; superintending the construction of experimental or other machinery, and advising all parties in any manner interested in patents or inventions.

☞ A pamphlet entitled "The Inventor Expert" sent to any address on receipt of cost in stamps [ cents.]

If he would only accept a position as a bass or tenor singer in some church choir, and live in some family where intellectual preëminence and fine conversational powers would be accepted as a requital for board, he could then get his pew rent and support for nothing.

The Old Colony Railroad Company has been having some of its cars rigged with that sort of a contrivance resembling an old-fashioned fireplace crane with which mail bags are hooked in while the train is going at full speed. At South Framingham, the other day, one of these cars attracted the attention of a countryman, who asked Conductor Lincoln what that contraption was for. "That," said Bezar, "is one of Harris's 'gospel cars;' and that thing is to hook in sinners with, and, after they're converted, drop 'em out again." We are afraid Bezar is little better than one of the ungodly.—*Marlborough Times.*

The Boston, Hoosac Tunnel, & Western Railroad Company has contracted with a London firm for the delivery of 40,000 tons of steel rails.

## LETTERS FROM PRACTICAL MEN.

### Making Mandrels—A Machinist's Mistake.

*Editor American Machinist:*

My method of making mandrels is to select best steel, center the same, drill the centers quite deep, countersink, square up the ends, turn each end down somewhat smaller than the required size, and for a distance sufficient to take on the dog, chamfer the ends with a round chamfer, flatten one side to receive the set screw of dog, and turn the body of the mandrel down to nearly the right size, on the larger sizes. I then drill a small oil-hole from the flattened side to meet the bottom of the center drill-hole. This hole will not only be useful for oiling the center without slacking up, but will also prevent cracking in hardening. At the time I finish the ends I also cup the center somewhat more of a bevel than that given by the center reamer. I then harden each end, drawing the temper according to quality of steel, so that I can just touch it with a file. After hardening, I finish to the right size, without filing, giving a slight taper. If intended for very accurate work, I finish by grinding in a dead-center lathe. For most work, when pieces have to be squared up to the mandrel, it is usually best to wrap the mandrel with a piece of thin writing, or other calendered paper, before driving, the object of which is to make sure not to scratch the mandrel. In driving into work, I use a piece of brass, with a hole sufficiently large not to touch or mar the center, or, on some work, I hit the end down on the end of a hardwood block, same as one drives on a file handle. The oil hole I mention should be stopped with a small wooden plug.

Some years since my present profession called me into the machine shop of one of our quartz mills; here I saw a man sweating away at a job, which he had on a planer. He was making, or trying to make, an under cut, at an angle of about 60°, for a gibbed slide rest, or something of that kind, and was using a Sellers planer. After noticing him break his tool several times, grind it, set it again, etc., etc., I remarked casually: "Isn't that a Sellers tool?" "Yes." "I believe Sellers tools are pretty good ones; this seems to be a pretty good planer." "That's all you know about it; it ain't worth a continental; I wouldn't give it shop room." "May be so, but I always liked his tools first rate. All I have ever run have been very accurate:" "Are you a machinist?" "Well, I have worked a little at the trade when I was a boy." "I didn't know that. I thought you was a civil engineer." "Yes, but I used to work at the trade a few years ago." Here, the whistle blew for dinner. During the dinner hour I asked the superintendent what kind of a machinist that man was who ran the planer. He said: "Why, he is first class. He was sent out by Smith & Co. to put up some machinery for Jones. After he got through I hired him."

About 2 o'clock I was again in the shop and found the man still sweating. He had just gouged out a piece of the work, thrown it from the bed, and broken his tool. He said to me: "Just look at this confounded planer; you can't do anything but straight work on it." I then asked him to let me try my hand a minute. He consented. I then refastened the work, put in a new tool, which I ground myself, to a proper shape threw the lift-apron over so that the tool would lift away from the work in running back, and made the cut down without any further trouble. This man had set the head at the correct angle for the cut, but had thrown the apron over so that the tool lifted into the work, instead of away from it. I then explained it to him. He said, "Why, I knew that, some one must have been in and shifted it for me; I wonder I didn't notice it." No doubt, this man may have been considered a good machinist, could undoubtedly do good work at the vise, and, possibly, on the lathe, but he evidently was no mechanic, and had very little knowledge of the planer.

Helena, Montana. G. B. FOOTE.

### The Cone Pulley Question.

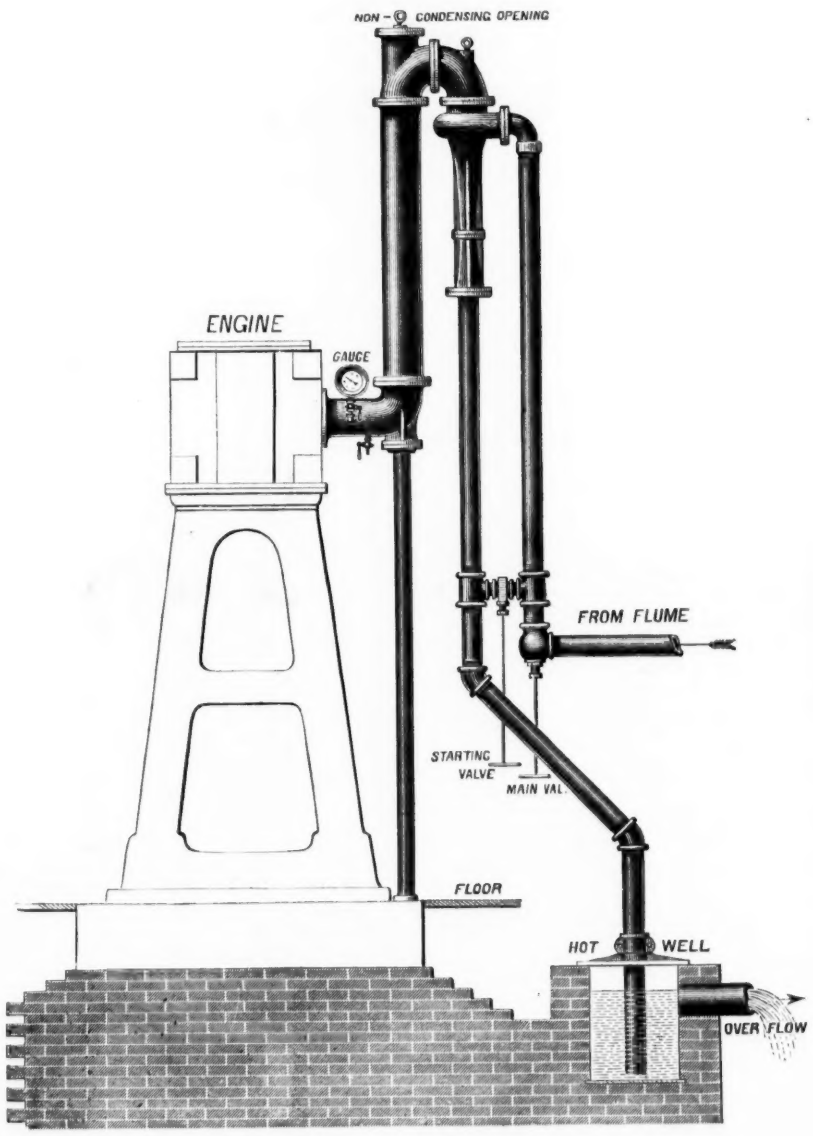
*Editor American Machinist:*

One of your correspondents (*votre ami*), on the cone pulley question, falls into an error in his criticism of Prof. Sweet's method of laying out cone pulleys, as described in your issue of September 17. By a casual inspection, it has appeared to him that the results made the sums of the diameters of the respective pairs equal, which is not the case.

Sweet's method is a very close approximation, and is a good, practical rule. If we take an example in which the belt angle, with the line of centers, ranges from 30° to nothing, the error will be about $\frac{1}{155}$ of the distance between centers. This is about the greatest error we can get. And in any practical case it is very much less, making it a good, safe rule to work by.

In calculating cone pulleys, it is not necessary to make any allowance for the thickness of the belt, as it makes no difference in the fit. In other words, if we take a correct pair of cones and add one inch to the diameter of each pulley, a belt $3\frac{1}{7}$ inches longer would fit all the changes correctly, though there would be a difference in the velocity ratios. The advantages of the method are these: it is as accurate as general practice requires, being nearer than we can turn pulleys or cut belts. It is very simple, any one can learn it in five minutes. It involves no cumbersome tables, which may be right and may not. It don't require any mathematical knowledge to use it. You can solve problems involving velocity ratios, and you can depend on the result.

Syracuse, N. Y. JOHN COFFIN.




THE CONDENSER CONNECTED WITH VERTICAL ENGINE.

### Boilers and Boiler Explosions.

*Editor American Machinist:*

Having read an extended and somewhat varied discussion in regard to the life of a steam boiler, also the best kind of boiler to use, I want to say that, while I do not claim to be an expert, I have had some experience in the use of steam boilers, and, as near as I can get at the case, there are no two boilers that give out in the same way, or, as nearly as I can judge, from the same cause. There are so many ways of treating a boiler—in the making, in the first place; man to run it and water used, in the second place; and condition as to being overworked, in the third place—that I fail to see any sense in determining its life to be just ten years.

I would suggest the idea of starting at the source of a stream to stop the water rather than at the mouth, and, for the safety of the boiler, would begin with the boiler maker. I have seen new boilers that ought to have been repaired before leaving the shop, yet they were sold for first-class work. I have lately had repaired an upright boiler in use three years—bought for first class, but caused continual trouble from leaking. It was taken to the shop, the rivets cut out and ring removed, which was found to be full of large blow holes filled with lead. The rivet holes in fire box and outside sheets were cracked entirely through. I saw the job while progressing, in order to satisfy myself of the quality of the work being done.

I have taken more notice of boiler work recently than usual, and must say I find too often poor workmen in charge, and, as might be expected, turning off poor work.

When boiler makers are compelled to do their work as it ought to be done, and users compelled to put a good man in charge, and to have proper examinations of their boilers made, as well as the quality of the water used; also to use a boiler large enough, so that it is not necessary to run with a white fire, or try to make steam with dirty water, boilers will last.

It does not seem to be quite the thing to compel a man to put in a new boiler every ten years—when well-made boilers easily and carefully fired, and with proper attention and good water, will be quite safe after fifteen years' service—because some one buys an old shell and hires a cheap man to run it, who fills it up with dirt, loads the safety valve down and blows it up. My idea is to buy a good boiler, hire a good man to run it ($1.25 or $1.50 won't hire him), and then to expect at least fifteen years' service from it. If it does not last that time some one is to blame, and if it explodes some one ought to be responsible for it. EX-ENGINEER.

### Direct Connected Engines.

*Editor American Machinist:*

In reference to C. C. Hill's communication and inquiry regarding over-head direct connected engines, it occurs to me you are the parties to reply. I will, however, state the case as it appears to me.

In favor of it: You dispense with a belt, that is, its first cost and cost of maintenance—quite an important item. Space in the building is also saved, and, necessarily, considerable friction.

Looking at the other side: With an engine connected in this way you must adapt speed to that of line shaft, or adapt the speed of line shaft to that of the engine, either of which may be inconvenient. Again, the expansion and contraction of the line shaft may cause trouble; besides, the line shaft is more likely to wear and settle out of truth than an engine shaft.

There is a condensing engine running a machine shop in Buffalo, and connected in this way, from which I never heard any complaint.

I think if an engine is connected direct, some sort of a universal coupling should be used. F. D.

Bradford, Pa.

## Locomotives of 1881.

BY WM. BARNET LE VAN.

In summing up the results of the year 1880, it was thought we had reached the extent of our current requirements in the manufacture of locomotives, but the past year has exceeded the former in the demands for locomotives, not only for home use, but for export.

The Baldwin Locomotive Works, of Philadelphia, have turned out 552 locomotives, and have orders sufficient to run the immense establishment at its full capacity for more than a year. Of the above number, eighty-eight were exported as follows:

| | |
|---|---|
| Mexico | 48 |
| Brazil | 16 |
| Australia | 15 |
| Cuba | 4 |
| Peru | 2 |
| Nicaragua | 1 |
| Central America | 1 |
| Sandwich Islands | 1 |
| Total | 88 |

The E. A. L. Roberts' locomotive, which they were about building, and which was claimed by the inventor to be able to run eighty miles an hour, was abandoned on account of Mr. Roberts' death.

The New Compressed Air Locomotive, built by them from designs of Robert Hardie, of Edinburgh, Scotland, has been making frequent and successful trial trips upon the Second Avenue Elevated Railroad, New York City, with every prospect of being all that its inventor claims for it.*

The Pennsylvania Railroad Company have turned out from their Altoona shops one hundred and four locomotives, as follows:

| | |
|---|---|
| Class B | 20 |
| " E | 13 |
| " I | 60 |
| " K | 9 |
| " L | 1 |
| " M | 1 |
| Total | 104 |

"Class K" is the designation of their fast passenger locomotives, such as are now in use on their "flying trains" between Philadelphia and Jersey City, the run being made in 114 minutes—distance, 88.4 miles—including one stop, or at the rate of 46.31 miles per hour.

The cylinders of these engines are 18 inches in diameter, with 24 inches stroke, the drivers being 78 inches in diameter. The tractive force exerted for each pound of effective pressure per square inch on the pistons is:

$$\frac{18^2 \times 24}{78} = 99.7 \text{ pounds.}$$

The weight on the driving wheels in working order is:

| | |
|---|---|
| 1st pair of drivers, | 33,600 lbs. |
| 2nd " " | 31,700 " |
| Total, | 65,300 lbs. |
| Average per wheel, 1st pair, | 16,800 lbs. |
| " " " 2nd " | 15,850 lbs. |

Mr. Theo. N. Ely, superintendent of motive power, has in these locomotives adopted the English plan of coupling rods—rods made solid in one piece, with the ends bushed to suit the crank pins.

The following indicator card was taken from the left side of locomotive No. 10, when running at the rate of 64 miles per hour, cutting off at 7 inches.

This company is also introducing the extended smoke box upon its locomotives.

The Philadelphia and Reading Railroad has placed on the Bound Brook route between Philadelphia and New York, and also on its main line, a number of fast passenger locomotives, having Wootten boilers and built by the company at the Reading shops.

The cylinders being 21 inches diameter and 22 inches stroke, and 68 inch drivers, the tractive force exerted for each pound of effective pressure per square inch on the pistons, is:

$$\frac{21^2 \times 22}{68} = 142.68 \text{ pounds.}$$

* Illustrated and described in AMERICAN MACHINIST, December 10th, 1881.

Total weight on driving wheels 64,250 pounds, or an average of 16,062 pounds per wheel. The schedule time between Wayne Junction and Bound Brook, 54.9 miles, is 64 minutes, including one stop and slowing down three times—once over the Delaware River bridge, which is one mile in length. This involves an average speed of 60 miles per hour for 54 continuous miles.

These locomotives, when running at high speed, doing full work, consume 53 pounds of anthracite coal per minute, and evaporate 450 pounds of water in the same time.

These locomotives have run at the rate of 72 miles per hour, pulling a train consisting of four well-filled passenger cars. Weight of train complete was 210 tons. The following indicator diagram was taken at the above speed, in which the scale of indicator spring is 80 lbs.; revolution per minute, 360, and boiler pressure, in pounds, 105.

Notwithstanding the unfavorable influence of a brisk north wind, and the thermometer marking 6 degrees below zero (Fahr.), the above card was taken upon a level, while cutting off steam at 8⅝ inches. Several miles were run continuously in less than 50 seconds.

Mr. Wootten has reduced the length of stroke of his engines, thus shortening his coupling rods to a minimum, and lessening the risk of breakage, which is a very serious drawback in fast-running locomotives.

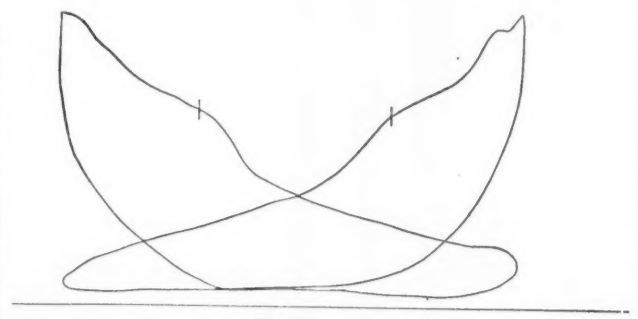


Fig. 1.

The Fontaine locomotive has been finished and put in service on several roads during the year and has proved, as all intelligent engineers had foreseen, not a success, it being virtually a locomotive on stilts.

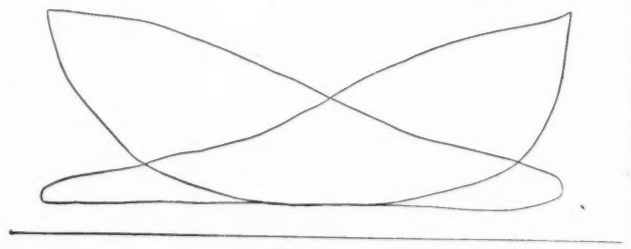


Fig. 2.

The following works have turned out during the year the number of locomotives set opposite their firm names:

| | |
|---|---|
| Baldwin Locomotive Works, Philadelphia, Pa. | 552 |
| Rogers Locomotive Works, Paterson, New Jersey | 225 |
| Hinkley Locomotive Company, Boston, Mass. | 200 |
| Schenectady Locomotive Works, Schenectady, New York | 176 |
| Manchester Locomotive Works, Manchester, N. H. | 116 |
| Pennsylvania Railroad Company, Altoona, Pa. | 104 |
| Danforth Locomotive and Machine Co., Patterson, N. J. | 103 |
| Grant Locomotive Works, Paterson, N. J. | 101 |
| Pittsburgh Locomotive and Car Works, Pittsburg, Pa. | 100 |
| The Dickson Manufacturing Co., Scranton, Pa. | 86 |
| Philadelphia and Reading Railroad Company, Reading, Pa. | 12 |

### THE SHAW LOCOMOTIVE.*

The Shaw locomotive, built by the Hinkley Locomotive Company, of Boston, made a trial trip over the Camden and Atlantic railroad, from Camden to Atlantic City, on the 19th of November last, with a train consisting of one Woodruff parlor car and two set-up cars. Weight of train complete was about 120 tons.

The Shaw locomotive was built to overcome the imperfect balancing, also the powerful side throw from right to left and from left to right, which causes a continual oscillation of the machine.

These oscillations are due to the admission of steam to the right-hand engine at the follower end, and in the left-hand engine at the crank end, which causes the front end of the locomotive to be thrown against the right rail and *vice versa*; although the weight of the locomotive may, in some measure, counteract this indirect thrust, still it does not altogether obviate the thrust against the flange of the wheel, and as this is kept up during a long run of the locomotive, the wear and tear of the wheel, rails and roadbed are necessarily very great; so, too, is the risk of "derailment." This locomotive is, no doubt, better balanced in its revolving parts, from the fact that the power is divided up by having two engines on each side, each developing an equal amount of work in opposite directions.

The distance run was 59 miles, and the time between Camden and Atlantic City, 77 minutes, which included two stoppages, losing six minutes at Egg Harbor and Absecon, the actual running time being 71 minutes, and rate of speed 50 miles per hour. The swiftest mile was made in 58 seconds, or at the rate of 62 miles per hour, and two consecutive miles, each 59 seconds, equal to 61 miles per hour.

I rode about twenty-five miles upon the locomotive, and found that the usual swaying motion from side to side was not perceptible, and that the machine ran smoothly and steadily.

The principle feature of dividing up the thrust, by taking steam simultaneously from the opposite ends of two cylinders is not new in the Shaw locomotive.

Mr. Thomas Dunn, of Manchester, England, published in *Engineering*, Vol. 9, page 296, April, 1870, an article with cuts, showing an arrangement in which three cylinders are employed, also a plan of two cylinders only, which will prevent the violent oscillations from side to side, now so common in fast-running locomotives.

In Mr. Dunn's first plan he connects the two outside cylinders to cranks, which are fixed on the axle in a line with each other, while the piston of the central cylinder is connected to a crank formed in the driving axle at right angles to the other two, thus:

He proposes to make the central cylinder of the usual size, while the outside cylinders are to have each half the area of the central one. The piston in the two outside cylinders moves to and fro simultaneously. There is no tendency to produce sinuous motion of the locomotive. In his two cylinder locomotive he seeks to accomplish the same result by the use of three cranks in the driving axle, two of these cranks being in a line with each other, while the third crank is at right angles to them. The connection with the cylinders is shown in the diagram marked Fig. 4.

These plans undoubtedly tend to promote steadiness of running at high speeds, but will not obviate the imperfect balancing of the revolving parts, which Mr. Shaw's plan does.

### IMPROVEMENTS IN LOCOMOTIVES.

All the recent improvements in the construction of locomotives have been in the direction of increase of speed, regardless of the destruction to the road bed, due to their increased weight. The prime cause of most of the railroad accidents and detentions to trains of to-day, is broken axles and rails. As to the latter, steel rails do not show as great a percentage of breakage as did iron rails formerly, but we must recollect that the mileage and freight have enormously increased within the last few years, necessitating the employment of heavier locomotives. With the high and increasing speed at which our passenger trains now run, and the great number of heavy Pullman cars attached to them, "concussions," due to the curvature and imperfections of our roads, absorb the principal portion of our locomotive power, and entail a heavy charge in the shape of working expenses.

If our road beds were built to suit the locomotive, in place of the locomotive to suit the road, we would reduce our working expenses *fully fifty per cent.*, beside reducing *accidents to a minimum.*

The weight of passenger locomotives, to overcome the curvature and imperfections of our railroads, increases the frictional resistances to over one-third the power developed.

Experiments were made by M. Regray, with his "dynamometer car" (see *Engineering*, September 16, 1881, page 287). By its aid, not only can accurate records be kept of the distance run, time, speed, and tractive resistance of the train, but the number of revolutions made by the driving wheels of the locomotive can be ascertained, and indicator diagrams taken simultaneously *within the car itself*, from both ends of both cylinders of the locomotive, and this without the use of any long steam pipes or similar sources of error. The most important feature of this "dynamometer" is, that it enables a simultaneous observation to be made of the pull of the draw bar and the power developed in the cylinders of the locomotive, and this enables the efficiency of the engines to be determined. Experiments were made on 118 trains, which were chiefly express passenger trains. Two of the locomotives of the above trains were identical, except a small difference in the diameters of cylinders, one being 17.33 and the other 17.72 inches. M. Regray found the power absorbed by internal friction in the 17.33 inch. diameter cylinder to amount to 34.2 per cent., and in the 17.22 inch. cylinder it amounted to 35.6 per cent., *being four per cent. in favor of the small cylinder.*

*Engineering*, commenting on these results, says: "These are very heavy percentages—far higher, we venture to say, than would have been generally anticipated from the results of experiments previously made at low speeds, and they merit careful attention." As for the pull on the draw bar—that is to say, the net effect exerted by the locomotive in pulling the train—it averaged in the case of the 17.33 inch. cylinder 42.5 per cent., and in the case of the 17.72 inch cylinder 41.6 per cent. of the tractive power developed in the cylinders. The average weight of train in the former case was 118.9 tons, running 28. 3 miles per hour, and in the latter, 130 tons, running 29 miles per hour. The quantity of coal consumed per hour, per indicated horse power, averaged 3.26 pounds, and water evaporated, 7.9 pounds per pound of coal, or 23.44 pounds of water per horse power in the former, and in the latter, 2.56 pounds of coal per hour per indicated horse power, and water evaporated, 8.7 pounds per pound of coal, or 22.3 pounds per indicated horse power. The coal in the latter was the better of the two.

### SMOKE AND CINDER NUISANCE.

It is almost a satire on the science of the age that *smoke* and *cinders* continue to roll from the stacks of our locomotives. Our long trains of palace cars following behind are blackened, and the passengers begrimed with soot and cinder.

The investigations of Charles Wye Williams on the combustion of coal are well known, and there is no excuse for not knowing what is required to be done to prevent smoke and to thoroughly burn all the gases evolved.

The cinders and unconsumed coal, clipped off by the force of the exhaust and carried through the tubes, can all be returned to

* Illustrated and described in the AMERICAN MACHINIST, June 18th, 1881.

the fire box and burnt. Why is it not done?

It is well known that perfect combustion can only be obtained by supplying sufficient air under the grate and in the combustion chamber, so that the oxygen will combine with all the carbon to form carbonic acid gas before reaching the tubes. The means for admission and distribution of air above the fuel, and the brick arch deflectors, so much used in the fire boxes of English locomotives, comes the nearest to accomplishing this end.

The production of smoke is but evidence of imperfect combustion, since smoke contains and owes its existence to unburnt carbon.

The true economy of fuel consumption in steam boilers is complete combustion before reaching the tubes. The combustion chamber that we hear so much about is simply room in which the air and gases mix and combine, and such room is indispensable. No combustion takes place in the tubes except the temperature is above that of ignition, because the tubes being filled with carbonic acid, steam and nitrogen, there is no room for air, without which there will be no combustion. The unconsumed gases are, however, ignited at or near the top of the chimney, where they are met by the necessary air.

### LOCOMOTIVE BOILERS.

The most economical mode of producing and using steam for our locomotives is a question of special interest at the present time for locomotive engineers.

All engineers agree that the disturbance in a boiler will be much less at a high than at a low pressure, and the escaping steam will therefore carry more water along with it at low pressure. For this reason the use of high steam pressure is desirable.

The boilers should have the tubes kept down near the center of the boiler, so as to give a large area of water level. This will be found to be an advantage in securing plenty of dry steam.

So long as we rivet the longitudinal seams instead of welding them, so long shall we keep down the real strength to two-thirds that which we might have with the same plates.

The ordinary design of boilers, in regard to the spacing of the tubes, retards the circulation of the water, and involves a corresponding reduction of steaming capacity, arising from the crowded arrangement of the tubes causing the burning out of a large number of tubes, due to deficient circulation of the water among them.

Less water, other things being equal, will be vaporized in them per square foot of surface, because all the steam generated around the lower tubes has to force its way successively between the upper tubes, alternately from end to end, displacing to that extent the water around the latter, and thus preventing contact with the metal. In other words, less water is in contact with each unit of area of heating surface in boilers with staggered tubes than in boilers with the tubes in vertical and horizontal rows. Hence to obtain an equal economic evaporatiou, a much greater proportion of heating surface to grate must be given, or a much less rate of combustion adopted.

Another obvious defect in our locomotive boilers is the tendency of the larger portion of the heated gases to pass through the upper tubes, provoking various ingenious expedients to equalize the draft, such as "petticoat pipes," "diaphragms," deflectors," etc., which devices also give rise to the use of the extended smoke box, which under no circumstances can do anything but uselessly transport a small quantity of hot cinders. These devices also have a tendency to retard as well as to equalize the draft, thereby necessitating a reduction of the orifice of the exhaust, thus adding additional back pressure to the engines.

It does not seem to have occurred to many engineers that any boiler may be economical or otherwise, in respect to fuel, according to the rate of evaporation, and that this rate is of necessity, almost always varying in the case of a locomotive boiler. For a given rate of evaporation—and we may as well say that by this term we mean the quantity of water evaporated in a given time—we may have with equally good reason a large fire grate and a slow rate of combustion, or a small fire grate and a quicker combustion. In both cases the same amount of fuel may be burnt in a given time, and the same quantity of heat taken up by the water; consequently, so far as mere economy of fuel is concerned, one boiler will be as good as the other. As for *heating surface*, this has really nothing to do with grate area, but merely with the quantity of fuel burned in a given time. "Heating surface," or rather the fire-box plates or tubes, through the substance of which heat is transmitted, is only effective in proportion to the difference of temperature on the opposite sides of the plate.

But whatever the proportion of difference of temperature on the opposite sides of a plate may be, there are always two conclusive modes of ascertaining whether a boiler is turning the fuel burned to good account. If the temperature of the escaping gases does not exceed that of the water in the boiler more than 100 degrees, there can be no doubt of economical evaporation, the difference in temperature between the escaping gases and the water of locomotive boilers is generally from 200 to 300 degrees.

Mr. Edward Wood, in his private report to the London and Great Western Railway Company, England, dated May 9th, 1853, showed that he got from the *small boilers of* 700 *square feet of surface* as much speed, evaporation and economy of fuel as was obtained with the *large* 30-ton locomotive, having 1,300 *square feet*, both locomotives working the same passenger trains, on the same road.

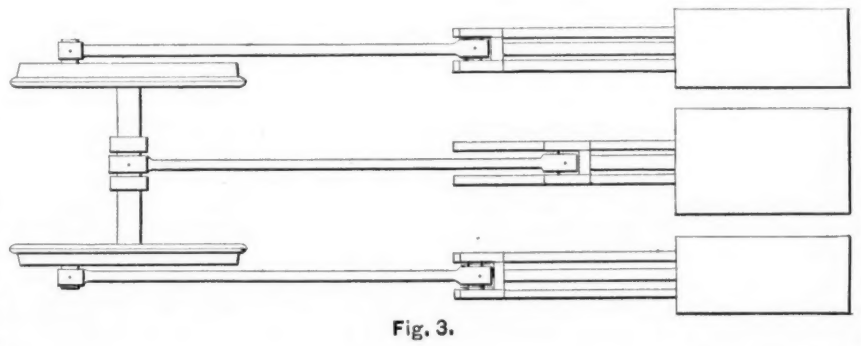


Fig. 3.

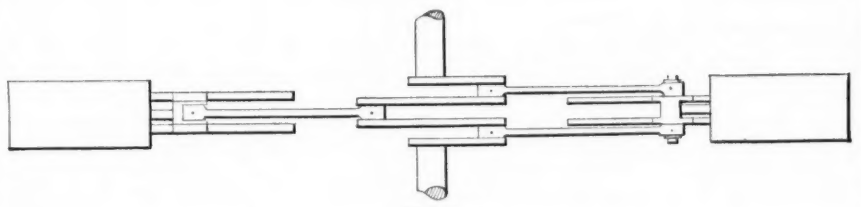


Fig. 4.

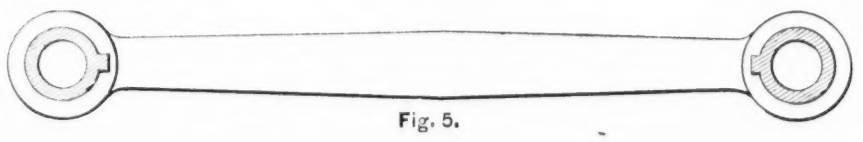


Fig. 5.

### LOCOMOTIVE BEARINGS.

The bearings of our locomotives have too small an area to carry the loads placed on them in late years. Experience has shown 12,000 pounds per wheel ought not to be exceeded, especially when the locomotives are intended to run at speeds above 40 miles an hour. The distribution of weight, with a 25-ton locomotive, may be easily and safely regulated, so as to have half the entire weight on one pair of driving wheels; but at the present time the weight of locomotives has been so increased that some of our fast passenger locomotives have as high as 16,800 pounds per wheel, and that so few run without heating and cutting, day after day, for months, is almost incredible. No doubt, the very verge of endurance is reached, and augmentation in the size of crank pins and axles is highly desirable. To do this length must be added to the journal boxes.

High-speed locomotives should have large, long and very carefully-fitted driving axle journals, with every precaution to prevent "knocking," and the slide valves should be balanced. The piston, piston rods, cross heads, connecting and coupling rods and crank pins should be of steel, and as light as is consistent with strength.

### PARALLEL OR COUPLING RODS.

The proper proportions, dimensions and form of section of parallel rods for locomotives running at high speeds is a problem which has not yet been solved, either in theory or practice—at least not in this country—from the fact that the parallel rod transfers the power to a second mover, and it is quite impossible to know with any certainty how the work exerted by the engine is distributed between the different driving wheels. The resistance due to coupling has been variously estimated, and, according to the best received theory, increases as the number of wheels connected. Whether this is or is not perfectly true we shall not now attempt to determine, as there is a manifest lack of experimental information on the point. With small wheels it is certain that the resistance must be much greater than with those that are large; and in any case it is now well known that the resistance caused by coupling but two pairs of wheels of our fast passenger locomotives must be of little or no consequence as compared with the advantages gained. It is evident that, so long as all four wheels are precisely of the same size—as they are when they leave the lathe in the shop—the presence or absence of parallel rods cannot in any way increase the rolling friction of the machine, the time occupied in completing one revolution being precisely the same with both pairs of drivers. If one pair becomes sensibly smaller than the other pair, resistance will, no doubt, be increased, as either or both pairs will have to do a little sliding as well as rolling. The smaller the wheels the greater will be the extent of the evil, and the more likely will it be that an inequality of circumference should exist—the wear caused by running a given number of miles increasing as the diameter of the wheels diminishes. A difference of one-fourth of an inch in the circumference of two wheels six feet in diameter will cause just one-half as much slipping and grinding per mile as a similar difference between the circumferences of two three-feet wheels; and this difference is far more likely to exist in eight coupled locomotives (consolidation), usually made with small wheels unequally loaded, than in fast express locomotives, with four wheels of large size. The loads on the latter may generally be made to correspond within a few hundred pounds.

It is now generally admitted that the rolling resistance of two pairs of driving wheels has been over-estimated; but engineers are far from admitting, with anything like unanimity, that the employment of parallel rods at high speeds is free from danger.

If the tram of the rod and the diameter of the driving wheels always remained the same, we would be sure that the whole tension would be divided up between the different wheels.

The work done by the connecting rod is known, but what proportion is transferred directly to the rail by the first pair of drivers, and how much is due to the parallel rod carried to the second pair of driving wheels, is hard to calculate with any certainty. What we do know is that, when one engine is on its "dead center," the parallel rod, when well fitted, is of the same length exactly as the center distance of the axles of the driving wheels. Just at this point no static momentum is acting; but, after leaving the center, there is nothing to prevent the stretching of the parallel rod more or less than the frame which carries the journal boxes, and at high speeds the extent of the elongation must be great.

Parallel rods in this country are generally made with the usual stub end, the wear of the brasses being taken up with a tapering key. This plan answered a good purpose as long as the locomotives were run at moderate speeds, but when high speeds became the order of the day, the breakage of the coupling rods began to be the rule instead of the exception. I have been informed that on the New York division of the Pennsylvania railroad, prior to 1881, the average breakage of parallel rods was three a month. All this was due to the system of making parallel rods of iron, and in three pieces—the two ends and middle. The stub ends were placed in the lathe when they came from the blacksmith shop, and turned and planed true to a gauge. They were then sent to the bench and the brasses and keys fitted up. The ends were then welded to the center piece, and after finishing up were placed on the engine. By this plan the engineer has it in his power to vary the length of the rod a little, by tightening up the brasses improperly. Occasionally the brasses were set too tight, and soon the crank pin became hot and set fast in the boxes, cutting both the former and the latter, thereby causing a heavy strain, also throwing the rods out of *tram*, the result being that the rods broke at the weak places, that is to say, at the welds.

The Pennsylvania Railroad have, by reason of the above causes, after a great number of experiments as to the proper form of coupling rod, adopted the English system of coupling rods on their fast passenger locomotives, known as "Class K."

The English coupling rods are made with solid ends, in one piece, from Bessemer steel, especially forged for the purpose, with broad ends, which are subsequently bored to a standard gauge, and then slotted, as they would be to receive a key. These ends are bushed with composition boxes pressed into them. The bushings are cast in iron moulds of exactly the right size. They are also slotted for a key corresponding to the slot in the ends of the rod. A key is thus cast on the bushing and fits in the key-way in the rod, after its bearing for the crank pin is bored out. By this process the rod is always in tram, and cannot be tightened or otherwise put out of order by the engineer.

The accompanying sketch, Fig. 5, will explain the manner of making them in England, as in use on the London and Northwestern Railway.

The bushings are made of "white metal," of the following composition: 1 of copper, 16 of tin, and 2 of antimony.

Bearings so fitted, will last, with moderate care, about six months, after which time the bushings are knocked out and replaced by new ones.

Most of the coupling rods in England are larger in the middle than at the ends, as they should be, theoretically, to resist alternate tension and compression. Those in use by the Pennsylvania Railroad are fluted, a section of which is similar to an "I" beam.

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In a Rochester (N. Y.) store a thermostat connected by clockwork, regulates, by the aid of electricity, the damper of a furnace, keeping, it is said, the temperature of the room, without variation, at any degree desired.

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NEW YORK, JANUARY 7, 1882.

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## Machinery Progress of 1881.

The stimulus of abundant orders for all kinds of shop tools, engines, boilers and railroad equipments has greatly encouraged substantial improvements in machinery during the year 1881. A prolonged feverish demand for shop tools and motors for manufacturing establishments might have been expected to repress almost any tendency to innovation of design while such a state of trade should continue, but the result has been to check little more than those questionable changes, such as seem to conflict with generally-received principles of correct mechanical practice. With a steady and profitable demand for the output of shop, mill or factory, proprietors are naturally averse to trying any doubtful experiments with machinery or fixtures. To this fact, in a great measure, is due the reliable and permament character of most mechanical devices introduced and applied by established concerns within the last twelve months. Our columns have from week to week borne numerous evidences of progress in designing and building lathes, upright drills, planers and shapers, milling machines, gear cutters, stationary steam engines, steam pumps, locomotives, steam generators, and special machines for a wide variety of purposes. An accelerated demand for these productions, of the exact styles now turned out, throughout the year just closed, does not seem to have prevented reasonable and desirable changes, nor is it probable that it will do so during the year before us. Reward or condemnation, in these busy times, is almost sure to follow swiftly the introduction of mechanical innovations.

Thus far there has been very little danger of an over-production in any class of shop equipments. The real trouble has been, and is likely to be throughout this year, to obtain within any reasonable time the tools and supplies needed in machine shop work. Electric lighting is very much retarded by the unavoidable delay in securing engines and dynamo machines, to put new plants into operation. Railroad and locomotive shops are seriously inconvenienced by waiting so many months for heavy tools and equipments, there being but few establishments in this country making a business of building such tools. With a hundred thousand miles of railroad in the United States, and with extensions going forward at a rate never before known, the need of special heavy tools for railroad shops is likely to increase faster than the facilities for supplying that need, especially as it would require months, if not years, to fit out a new shop and make ready to turn out machinery of this class.

## Locomotive Boiler Fixtures and Slide Valves.

Considerable discussion has arisen among railroad men upon the subject of locomotive boiler appliances and fixtures.

Some advocate the placing of all cocks and valves within the cab upon one stand, to avoid cutting more than one hole in the boiler shell or wagon top. This suggestion is all very well so far as it goes, but it does not go far enough.

Those who advocate new things ought to explain how they should be made.

We rode on a locomotive not long since which had all the cocks within the cab attached to a stand. The throttle stem also passed through this stand into the dome.

When the throttle was closed, the water of condensation within the stand ran out at the stuffing box of the throttle stem all over the jacket, making an unpleasant muss.

Whenever the throttle was open the water was drawn away. The same fault existed with this arrangement that exists with the majority of steam jackets upon the cylinders of steam engines. The stand was not drained properly, so the water ran out anywhere it could find a place; whereas, if the stand had been correctly made, this water would have returned to the boiler.

Until within a few years past it was generally supposed that pumps were the only reliable means for feeding the boilers of locomotives. This supposition was then correct, but since the injector has been brought to such a state of perfection, pumps have been gradually thrown aside, until all the leading railroads are using two injectors upon each locomotive instead of pumps, as they are considered more reliable and work more economically, besides being exempt from the usual wear and tear of pumps. While the means of feeding locomotive boilers have been changed so as to feed hot water instead of cold, the positions of check valves remain unchanged. The injectors are placed in or quite near the cab, and the feed water, after passing through the injector, should enter the boiler at once, in order to secure the economy due to the high temperature of the feed water. But, instead of that, the feed water after leaving the injector has to pass through a long pipe, exposed to the cold air in Winter, which greatly reduces the temperature of the feed water. Check valves, in the majority of instances, are located near the front end of the boiler, where, in case of a collision with the rear of a train, they are almost certain to be knocked off, and the hot water and steam freely distributed among the imprisoned passengers, the results being well understood from instances of the kind on record. Check valves should be placed upon the back head of the boiler, as near the bottom as convenient, where they will be well protected in case of a collision, and hot water prevented as much as possible from escaping from the boiler.

We know a locomotive builder who placed the checks upon the back head of several locomotive boilers, as described.

The master mechanic of the railroad where those locomotives were at work complains that the checks would have to be changed, as an immense quantity of dirt and sediment was deposited around the fire box, so as to become dangerous. He wanted the checks placed in the old position upon the cylinder part of the boiler, just as if the change would reduce the quantity of dirt deposited within the boiler. The truth is, the dirt is deposited in the cylinder part of the boiler upon and among the tubes, where it is not seen, but it is there all the same; and, if the bottom rows of tubes were kept clean, they would, in many instances, be turned off.

If dirty water is used in boilers of any kind, they should be frequently washed out. If they require it every week, it should be done. We remember an instance some months ago where a set of tubes were greatly damaged and several of the bottom rows burned out by reason of the dirt within the boiler. They were repaired, and the same thing occurred again. Finally, the suggestion was made to wash the boilers once a week if they were dirty, which suggestion was carried out, since which time there has been no trouble from that source. It has also been noticed that the valve seats and cylinders are not scratched as much as previously, and the boilers steam very freely, which, of course, *reduces the coal* consumption. BOILERS SHOULD BE ALWAYS WASHED WHEN THEY ARE DIRTY.

Sufficient care is not observed in cleaning boiler tubes, and they are often allowed to go six months without cleaning.

Boiler tubes when once cleaned should be kept so, and not allow the deposit to become hardened so as to require boring out with a bit. The wages of one or two extra men to wash boilers and clean tubes could be more than saved in the results produced. One great mistake in building locomotive boilers is the placing of too many tubes in them. One of the leading railroad companies in this country is building all of its locomotive boilers with a $\frac{3}{4}$" space between each tube. The result is reduced cost of construction; the boilers can be kept cleaner, they hold more water and steam better. We remember an old engine that had about half the tubes plugged up, and yet pulled as large a train and furnished as much steam as when all the tubes were intact. The reason for this was that the fewer tubes were kept cleaner than the whole when in use. Steam tube cleaners are made at the present day so simple that they could be easily attached by a hose to a cock upon the boiler within the cab, and the tubes blown out once a day, the whole operation requiring only a few minutes.

We can refer to instances where tubes and flues upon boilers are cleaned every morning, and a man is hired for that particular purpose. More than his wages is saved in the coal consumed. During the past few years the weight of locomotives has been much increased, more power is required, and a greater speed has become necessary. To accomplish this has rendered necessary an increase in the steam pressure and size of the steam and exhaust ports; which also means an increase of friction upon the slide valves.

Since these changes have taken place much trouble has been experienced with valves and seats. The weight of the former has been increased until the Allen pattern of unbalanced valve, as an example, weighs about one hundred pounds each, and the seats have to be faced about every three months. Each valve has about seven and one-quarter tons pressure upon it.

We are reaching a point where balancing valves must be adopted, in order to save the excessive wear and tear upon the valves, valve seats, links, eccentric straps, and, in fact, every part that goes to make up the valve motion. Only sufficient pressure should be allowed upon each valve to hold it upon its seat, at all points of cut-off. There are balanced valves in use upon locomotives which have run three and one-half years without one cent expended upon them for repairs, while others have run ten years, with the renewal of inexpensive parts. If a good balanced valve was adopted, the valves could be kept square with no difficulty, and the wear and tear of the most particular part of the locomotive greatly reduced, which would be an essential element in true economy.

With this issue we begin Vol. V., which will constitute the numbers of the AMERICAN MACHINIST for 1882. We have discontinued our department of "Newly Incorporated Companies," for the reason that most of the companies receiving charters of incorporation never do anything beyond marketing some of their stock. We shall publish notes of new companies in our department of "Manufacturers," whenever they establish works or do anything of special interest to our readers. This week we present some engravings and a description of the swiftest American locomotive, and a review of the "Locomotives of 1881," by W. Barnet Le Van. These articles take up a large portion of our space this week, and will be read with especial interest. Their length, however, prevents our giving the usual variety of contents this week. On pages 2 and 3 will be found another interesting article on foundry matters, by Thos. D. West. These articles will be continued regularly for some time to come. The "Shop Kinks," by L. F. Lyne, will also be continued from week to week.

## How Closely Does a Machinist Measure?

In connection with the question of standard gauges and measuring instruments of perfection, it is interesting to notice how closely the machinist works with the *ordinary* tools of his trade.

Some little observation of a workman engaged in boring locomotive driving wheels and fitting shafts to them, led to the following:

The wheels were bored with a tool, and of a taper of $\frac{1}{64}$" in 7". They were bored in a remarkably good lathe, but not to *exactly* the same size. A certain distance was fixed upon as proper for the wheel to be forced on the shaft, after allowing the shaft to settle into the wheel (which was laid down on the floor) by its own weight, and the workman would not make a variation of more than $\frac{1}{8}$" in that distance.

Making allowance for want of truth in the hole and shaft (although it was extremely difficult to detect any variation), it is safe to say that the machinist was working within $\frac{1}{4000}$ of an inch. To do this, he must first measure the hole in the wheel with his calli-

pers, transfer that measure to another pair of calipers, and again transfer that measure to the shaft he was turning. Making allowance for the fact that a machinist cannot turn as fine as he can measure, it may be safely concluded that he will work so closely, that the variation will scarcely be noticeable in a fit. However closely he may work, the fact should not be lost sight of, that he cannot define the size to which he is working, without the use of some sort of a measuring instrument of perfection. In other words, he can work almost infinitely closer than he can measure, by the use of ordinary tools.

## QUESTIONS & ANSWERS.

*Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.*

(1) L. C. E., Brooklyn, N. Y., asks if he would be infringing any one's patent by making a shaking grate bar, if he made it substantially unlike any in use? *A.* No; there is no patent on shaking a grate bar, although there are several on a shaking grate bar.

(2) A. C. L., Brownsville, Texas, asks: Which expands the most by heat, cast iron or wrought iron? *A.* Wrought iron.

(3) L. G., Hamilton, Ohio, writes: One rule for finding the pitch diameter of a gear wheel, when the number of teeth and the pitch are given, is: Divide the pitch by 3.1416, and multiply the quotient by the number of teeth; the product will be the pitch diameter. The other rule is one that I know to be in practical use in two shops, and is as follows: Multiply the number of teeth by the number of 1-32″ in the pitch, and cut off two figures from the right. Which of these two rules is correct and the most generally used? *A.* The first one.

(4) J. T. B., Mt. Vernon, Ohio, asks: Which is the front end of a steam engine cylinder? *A.* The front end of a locomotive cylinder is the end furthest from the guides; of a stationary engine, the end nearest the guides.

(5) S. W. D., Brooklyn, N. Y., asks how he can make a torch about ½″ in size, of some material that will burn (not explode) with a hot flame as soon as touched by fire; that will not ignite by friction or from concussion; that will not be injured by exposure to the atmosphere, and that will be hard but not crumble? *A.* We are not acquainted with anything that will fulfill your requirements.

(6) H. F., Chicago, Ill., and others, say, in reference to answer to J. J. B, December 10, that the thread may be cut by compound gearing, and give the gears to cut it. J. J. B., while he did not write specifically that the lathe was simple geared, did write in such a way that we so understood it, and we answered him accordingly, and supposed it would be similarly understood by our readers.

(7) G. W. C., Leavenworth, Kansas, asks: How shall I make a worm wheel and screw so as to divide or space accurately up to 100? *A.* If the wheel is large, make it of one hundred or an even number of hundreds of teeth, as 100, 200, 300, etc., and by making a single stop you can readily space by noting the number of times you turn the screw. If the wheel is small you will have to make a dial to use in connection with the screw, thus: if of 50 teeth, there must be two notches; if of 25 teeth, four notches, and so on. The accuracy with which it will divide, will depend upon the accuracy with which the work is done.

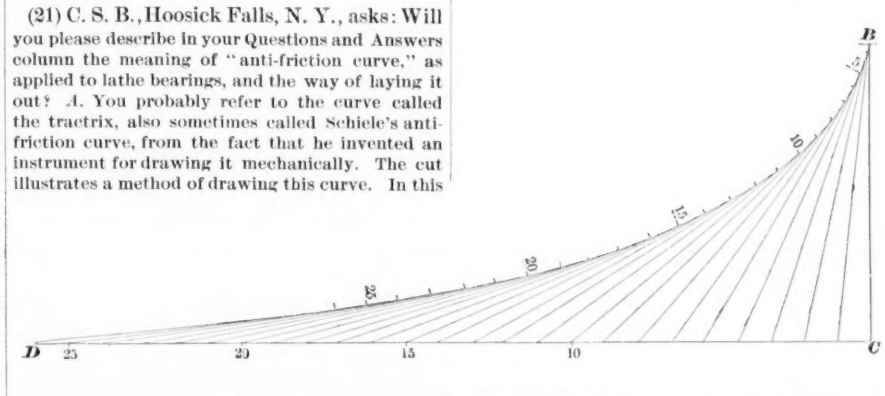
(8) J. L. M., Baltimore, Md., writes: I am building a machine, which is in the form of a steam engine, to compress material up to 10,000 pounds to the square inch. The pressure against the plunger will be 32,000 pounds, but only for about one-eighth of the stroke. What I want to know is, if my crank pin, which is 4″ in diameter and 6″ long, is large enough to allow of the lubricant remaining between the surfaces, or will the pressure be so great as to force it out? *A.* Your pin is rather small, but if the speed is slow, by using a heavy body oil it will probably do.

(9) R. E. R., New York, writes: 1. I desire to place a lathe, weighing about 700 pounds, in the middle of a floor, under which the beams are 3″x8″, 16″ apart, and 18 feet long. Will the floor sustain this weight? *A.* Yes, if not too heavily loaded already. 2. Will the vibrations due to the treadle motion have any effect on the safety of the floor? *A.* Yes; while you will be able to run your lathe on this floor, at the same time the timbers are only about one-half the depth that they should be for reasonable stability.

(10) W. J., Washington C. H, Ohio, asks: 1. What hydrostatic pressure shall I test my boiler at to make it safe at 100 pounds steam pressure? *A.* Testing your boiler with cold water pressure to any extent will not make it safe under steam. Have your boiler examined by a competent man, and if pronounnced all right test to a pressure of 175 lbs. 2. Can I test it with a hand pump, and from the indication of an ordinary steam gauge? *A.* Yes, if the pump will work against that pressure, and if the gauge is correct.

(11) G. B. C., Kalamazoo, Mich., sends us sketches illustrating two ways of making riveted joints, as in boiler work, etc. In one sketch there are two rows of ¾″ rivets, 1¼″ apart (centers), the rivets in each row being pitched 3⅜″, and staggered so as to make what is termed zigzag riveting. In the other sketch there are also two rows of rivets of the same size and pitched the same, but placed in line each way, making what is called chain riveting. In the last named sketch the two rows are 2½″ apart (centers). He asks: 1. Which is the strongest to resist tensile strain? *A.* You do not give the thickness of plate, but assuming it to be in proportion to the rivets, we think the latter, or the chain riveting, the strongest. 2. If, instead of the two rows in the chain riveting being 2½″ apart, they are made 2¼″ apart, and the rivets are pitched 2¾″, which will be the stronger? *A.* The chain riveting.

(21) C. S. B., Hoosick Falls, N. Y., asks: Will you please describe in your Questions and Answers column the meaning of "anti-friction curve," as applied to lathe bearings, and the way of laying it out? *A.* You probably refer to the curve called the tractrix, also sometimes called Schiele's anti-friction curve, from the fact that he invented an instrument for drawing it mechanically. The cut illustrates a method of drawing this curve. In this




example divide the line *C D* into any number of equal parts, and at *C* erect the perpendicular *C B* (length assumed at pleasure.) From the several points of divisions on the line *C D*, draw lines to the point *B*. The problem now is to draw a curve from *B* that shall cut these lines in such a way that they shall all be of the same length, and equal to *C B*. This may be done by laying off on each of these lines a distance equal to *C B*, and drawing a curve through their extremities.

## BUSINESS SPECIALS.

*50 cts. a line for each insertion under this head.*

**Presses & Dies.** Ferracute Mach. Co., Bridgeton, N.J.

James W. See, Consulting Engineer, Hamilton, O. Presses and Dies. Ayar Mach. Works, Salem, N. J.

Alfred Wilkinson, Expert Tests of Steam Engines and Boilers, 123 N. 4th St., Phila.

List of Machinists in U. S. and Canada. Price $10. A. C. Farley & Co., Philadelphia.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

Wanted—To sell a 30 in. Swing Lathe and to buy a 60 in. one. Unadilla Machine Works, Unadilla, N. Y.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

"How to Keep Boilers Clean," and other useful information for steam users and engineers. Sent free by the publisher, Jas. F. Hotchkiss, 84 John Street, N. Y.

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Persons interested in the various methods of lighting by Gas or Electricity, furnishing Steam for Heat and Power, and Gas for Fuel, and who have reasons for wanting the actual facts in regard to the different systems, are invited to read the *Sanitary Engineer*, a weekly journal that employs the ablest experts to treat these subjects, and aims to tell the exact truth. Commenting on its recent change to weekly issue, the *Cincinnati Gazette* says: "The success of this publication has been marked in many ways. Not only has it become a source of profit to its projector, but it has been of incalculable value to the general public, whose interest it has always served. It has affected legislation, both State and National, and bids fair to continue the recognized American authority on all departments of sanitary engineering." Published every Thursday, at 140 William St., New York, at $3.00 per year, post paid. Single copies 10 cents, which should be ordered of newsdealers.

## MANUFACTURES.

The Ball Engine Company, Erie, Pa., are building one of the Ball cut-off engines every day.

The Pittstown Paper Company is building a new mill to be run by steam at Utica, N. Y.

Powell & Douglass, Waukegan, Ill., have recently shipped two wind-mills to New Zealand.

Wheeler & Heyer, St. Johnsbury, Vt., are full of orders for their iron frame box machinery.

Perigan & Avery, threshing machine manufacturers, of Groton, N. Y., are starting a branch shop in Davenport.

The Novelty Iron Works, Dubuque, Iowa, have the plans ready for a large addition to their buildings in the Spring, and are crowded with orders.

The Massachusetts Screw Company, Holyoke, Mass., are making 3,000 gross of screws daily. They are making shipments to South America.

Messrs. Rice & Freeman are to erect a large combined stone and roller mill at Chattanooga, Tenn.

Clark & Knight, Worcester, Mass., steam engine builders, are increasing their facilities to keep up with orders.

The Bessemer Steel Works at Steelton, Pa., are to erect two blast furnaces and a large Bessemer furnace.

The Cambria Iron Works, Johnstown, Pa., are employing three sets of men, each working eight hours.

The Knowles Steam Pump Works, Warren, Mass., are employing two sets of hands, running day and night.

The Ohio Central Railroad Company has decided to establish works at Bucyrus, Ohio, and manufacture their own locomotives.

The United States Rolling Stock Company is using the Edison electric light in their works at Chicago.

Rockford, Ill., has a new sewing machine company incorporated; capital, $100,000; stock all taken. W. F. Barns is Vice-President.

W. D. Hartupee, Pittsburg, Pa., is building a high-speed engine, with cylinder 18″x24″, for the Union Steel Company, Chicago, Ill.

The Windsor Locks, Conn., Machine Company will start their new works in the course of a week or two.

Babbitt, Wood & Co., New Bedford, Mass., are to build three horizontal boilers for the American Tack Company, and have contracts for a large number of the Park heating furnaces.

The Eureka Manufacturing Company, Rock Falls, Ill., manufacturers of mill machinery, will increase their facilities by building a three-story stone building, 40x80 feet.

W. F. & John Barnes, Rockford, Ill., have largely increased their facilities to supply lathes and tools, but are still complaining about orders in excess of their capacity.

The Meriden, Conn., Silver Plate Company will build at once a five-story addition to their factory, into which they moved scarcely more than a year ago.

J. I. Case & Co., Racine, Wis., are making preparations for an enlarged business in the Spring. Their new portable saw mills, Mr. Walruth, the Superintendent, says are a big success.

Some citizens of East Bridgewater, Mass., have bought the old Matfield Locomotive Works, and after putting them in repair will turn them over to a company, which will commence the manufacture of petroleum engines.

The Excelsior Iron Works, Chicago, Ill., have a contract to furnish a 150-horse power high-speed engine for Fowler's new rolling mill at Englewood, Ill. The engine will be connected directly with the spike mill train.

The Remington Agricultural Company, Ilion, N. Y., have made arrangements with B. J. C. Howe to manufacture and sell extensively the horse power fire engine which was mentioned in our column of manufactures, in the June 4 issue of the AMERICAN MACHINIST. It is claimed that it can be furnished to villages, suburbs of cities, or manufacturing establishments, at about one-fifth the cost of a steamer, and can be operated at even a greater per cent. of economy.

The New England Pulp Package Company are arranging to remove their works from Hartford to Boston.

The Holly Manufacturing Company, Lockport, N. Y., have fifteen contracts for water works and pumping machinery. They will increase their capacity by the erection of additional buildings.

The Leonard Co-operation Foundry Company, Taunton, Mass., are employing more men than ever before. Their foreign trade is extensive, large shipments of stoves being made to England and South America.

George W. Fifield, Lowell, Mass., is busy on all sizes of engine lathes, from 16″ to 48″ swing. He has doubled his force of workmen during the past year, the production now being one lathe per day.

Hewes & Phillips Iron Works, Newark, N. J., are building a planer for Watts, Campbell & Co., of that city, to plane 8 feet square by 25 feet in length, also a large number of smaller sized planers. They are receiving a great many orders for their new Allan High Speed Engine.

Wm. H. Hope & Co., who recently succeeded Elliot & Co. in the manufacture of milled machine screws and taps, at Lowell, Mass., are busy filling orders. The members of the new firm have gained their knowledge of the business by fifteen years service with the American Bolt Company.

The Lowell, Mass., Boiler Works are building extensive additions, consisting of a main building 104x50 feet, an annex 104x20 feet, and a 50-foot tower for a riveting machine. They are building for one concern ten tubular boilers 17 feet long, and for another a 9-foot penstock 250 feet long.

W. W. Guptill has bought out the mould-making and machinist business of E. N. Cleaves, 69 Haverhill Street, Boston, Mass., and will continue the business at that location. Mr. Guptill is an experienced practical machinist, and starts in with plenty of orders.

T. Daniel, 60 Fulton Street, New York, has fitted up his pattern shop with the most approved tools and appliances, and is working a number of skilled pattern makers. He is giving his personal attention to the details of the business, and proposes to make first-class patterns of all descriptions, paying particular attention to complicated cored work, and patterns of difficult construction.

The Eufaula Oil Works, Eufaula, Ala., are preparing to enlarge their capacity for making cotton-seed oil. They have at present four hydraulic machines for expressing the oil, and run day and night, consuming twenty tons of cotton seed per day, and turning out fifteen barrels of oil and eight tons of oil-cake. The oil is refined and used like olive oil, and the cake is ground into meal, making an excellent fertilizer.

The Geo. T. Smith Middlings Purifier Co., of Jackson, Mich., have commenced the foundation for a large flouring mill having a capacity of 1,000 to 1,200 barrels per day, which is to be fitted up with all the modern improvements. The mill will have sixty sets of rolls, and forty of Geo. T. Smith's Patent Middlings Purifiers. It is the intention of the proprietors to have the mill second to none in America.

One of our traveling correspondents writes us: "Davenport, Iowa, is on the boom. A company for manufacturing vinegar has been organized (capital, $25,000), and are now putting up the buildings. The Glucose factory has been enlarged, and is now consuming about 3,000 bushels of corn per day. The Phoenix, and also the Farmers' Milling Co., have enlarged. The Eagle Manufacturing Co. and Davenport Plow Co. are putting forth extra exertions to try and keep up with their orders. Ebi & Newman have started their new foundry, and it goes off in good shape.

A. L. Crocker, of the firm of Crocker & Pell, machinists, engineers and founders, Minneapolis, Minn., writes us that their shops are nearly completed, although they are delayed somewhat in waiting for their boiler and tools. They have secured foremen for their different departments, and are pushing hard to commence operations as near the first of January as possible: Are meeting with every encouragement in the way of prospects for business, etc. Business in Minneapolis is generally good, except milling, which is for the moment quiet, owing to the fire and the scarcity and poor quality of wheat: The C. M. & St. P. R. R. Company are hauling stone for the foundation of their new car shops, which are to be larger than at first intended.

The stock of the John P. King Manufacturing Company, of Augusta, Ga., amounting to $1,000,000, has all been taken, and the work of organization will be pushed forward at once. They will erect a large cotton mill as soon as possible.

The number of scales made by the Fairbanks Scale Works at St. Johnsbury, Vt., during the past twelve months has exceeded 63,000, or 8,000 more scales than were sold in 1880. The company has made 4,000 hay scales and 400 iron frame railroad track scales. The number of post office scales made under contract with the United States Government the current year was 2,500. In the manufacture of a hundred varieties of scales there have been used the past year 5,000 tons of pig iron, 500 tons of bar iron, 175,000 pounds of steel, 25,000 pounds of brass castings and 2,000,000 feet of lumber. The Fairbanks Scale Company employs 600 men, to whom it pays in wages $350,000 per annum. The business done by the company approximates the sum of $5,000,000 a year.—*Boston Commercial Bulletin.*

## Machinists' and Engineers' Supplies.

NEW YORK, Dec. 22, 1881.

Business in the supply market continues active, the weather holding remarkably favorable for transportation. The continued advance in the price of Pig Iron must necessarily be followed by an advance in manufactured goods and material.

The Pump Manufacturers have just issued a new advance price list.

## Iron and Metal Review.

The Pig Iron market is fairly active and higher prices are obtained.

We quote foundry No. 1. at $26.50; Foundry No. 2 X at $24; Gray Forge, $23. The Foreign Iron market is a little stronger, if anything, than last week. We quote Gartsherrie at $25 to $26; Coltness, $26.50 to $27; Glengarnock, $24 50 to $25; Carnbroe, $24 to $24.50; Eglinton, $23 50 to $24. Steel, Iron and Old Rails unchanged.

The demand for copper is fair at 20¼c. to 21c. for Lake Superior. Straits Tin, 24c. to 24¼c. Australian and Billiton the same. Lead, 5¼c.; Spelter, Western, 5¾c. to 6c Antimony 14¼c. to 14½c. for Cookson; American, 13c.

## WANTED

A young man, Mech'l Draughtsman, wants situation. Address F. L., 40 First St., Brooklyn, L. I.

Wanted—A situation by Mech'l Draughtsman. Address BOX 12, AMERICAN MACHINIST, 96 Fulton St., N.Y.

Wanted—Several first-class men to erect engines. Address The Hartford Engineering Co., Hartford, Conn.

Wanted — Immediately, three Pattern Makers; apply at once at the Factory of Grant & Bogert, Flushing, L. I.

A machinist with best references wishes a situation as foreman or superintendent. Address Box 702, Lowell, Mass.

Wanted—Parties with capital and tools to manufacture my improved Oscillating Engine, Pat. Feb. 3d, 1880 The cheapest engine built. J. F. Kingsley, Sayre, Bradford Co., Pa.

Wanted—Two first-class Tool Makers, accustomed to Sewing Machine or Die Work. Address, The Dueber Watch Case Manufg. Co., Box 1334, Cincinnati, Ohio.

Wanted—A millwright in a wood-working establishment that can make patterns. None but sober, steady men of experience need apply. Address S., care Chester and Harris Mfg. Co., St. Louis, Mo.

A Mechanical engineer and draughtsman understanding German, French, and English, also well versed in Patent Office drawings, wants a situation. First-class references. Address M. N., Box 130, Stamford, Conn.

Wanted—Parties with capital and tools to manufacture my Automatic Cut-off Engine, equal to the best, and having the most perfect system of regulation known. Endorsed by the highest mechanical authority. Address A. C. O., AMERICAN MACHINIST, 96 Fulton St., New York.

Wanted—A Machinist and Boiler Maker. To sober, steady, and good workmen, will be paid good wages, and get steady employment; wanted to do repair and job work. The machinist must thoroughly understand steam engine repairing. Address, P. O. Box 338, Dallas, Dallas Co., Texas.

A large company wants a mechanical engineer, who understands, theoretically and practically, steam and machinery, and who can manage men, run the machine shop, foundry, etc. He will not be required to attend to the commercial business. To a competent man a liberal salary will be paid. Address, giving age, married or single, references and salary expected, Box No. 262, New York P. O.


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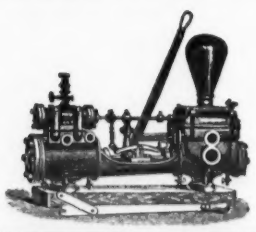

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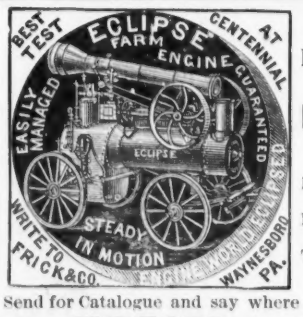


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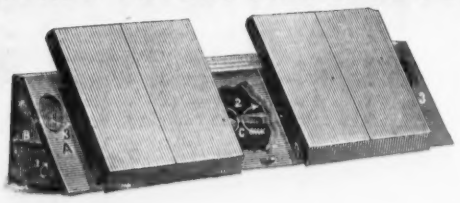

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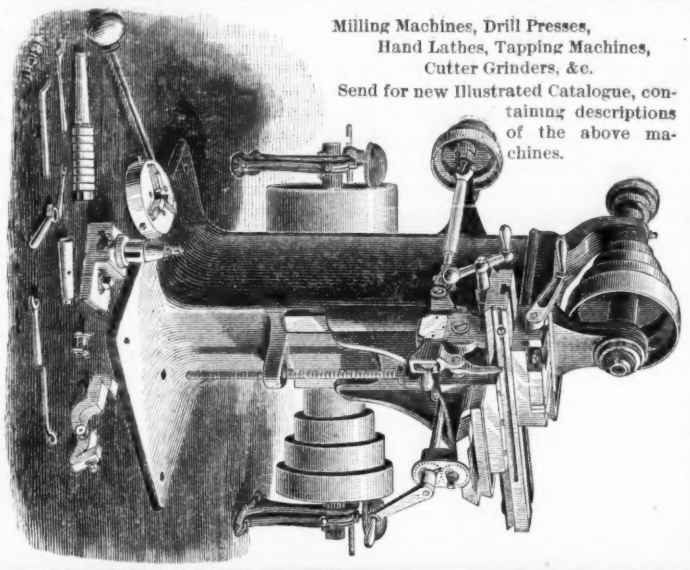

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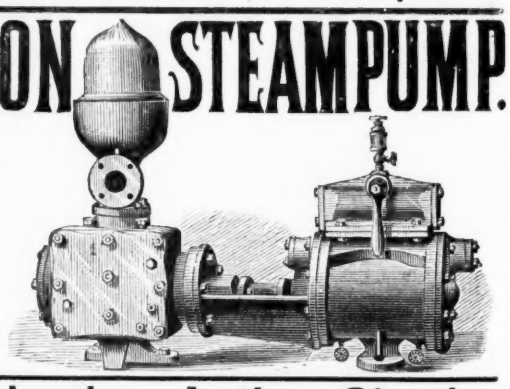



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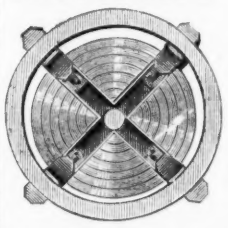

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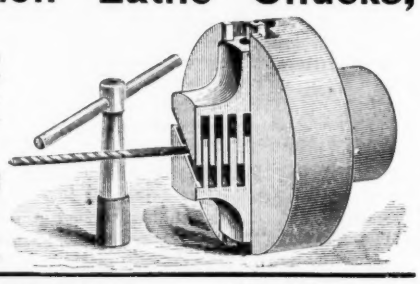

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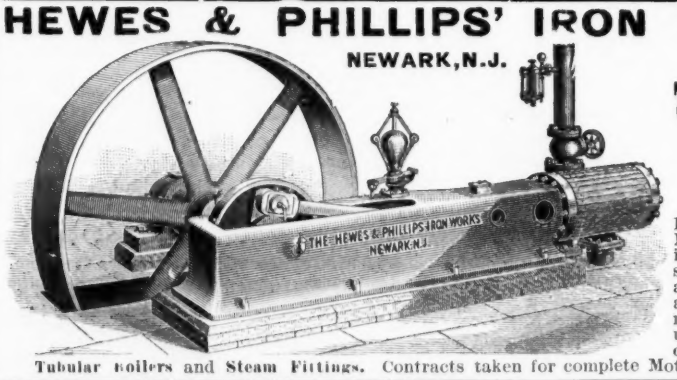


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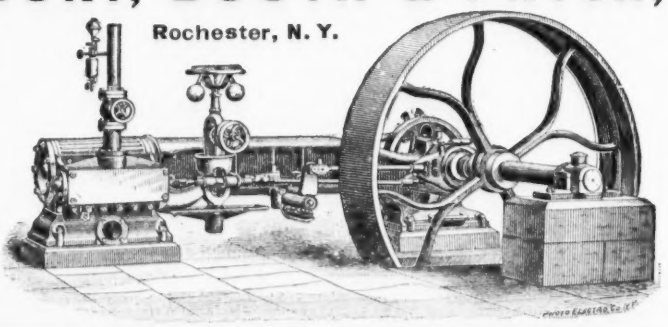



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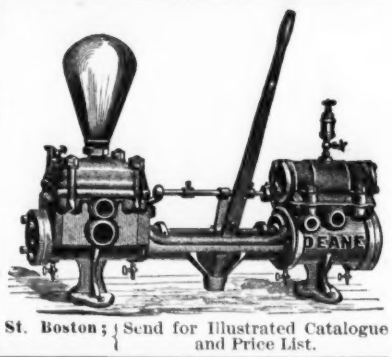


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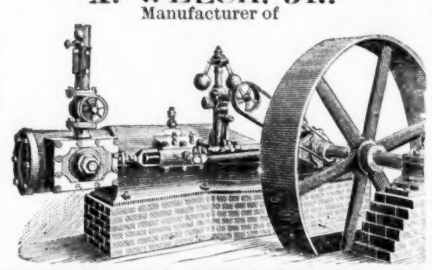

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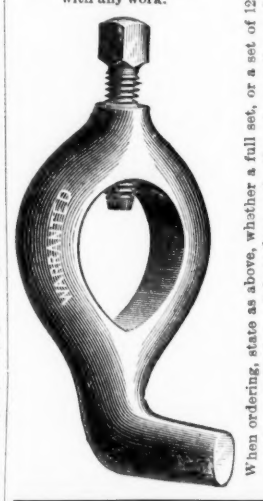


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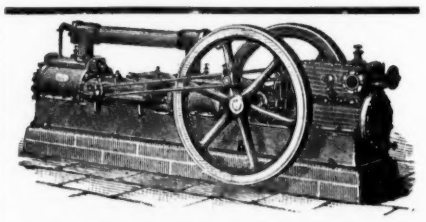

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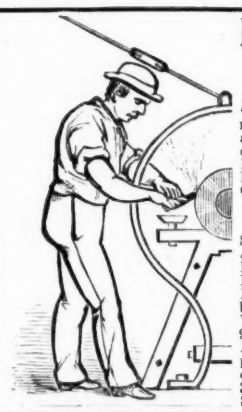

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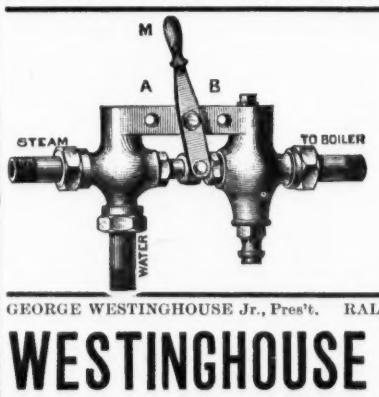


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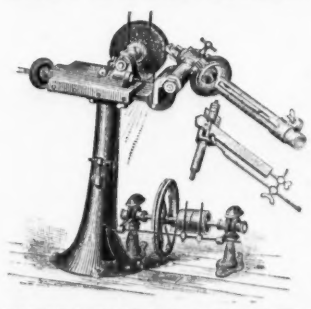

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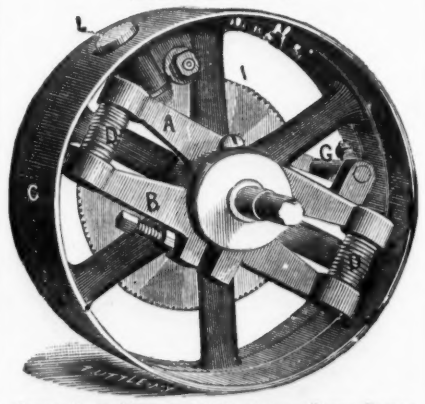


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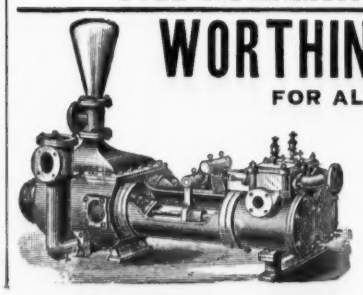

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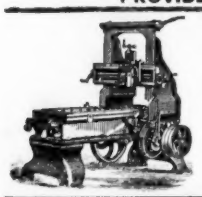

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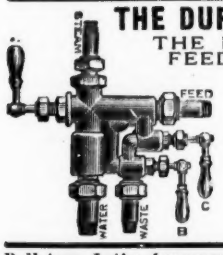


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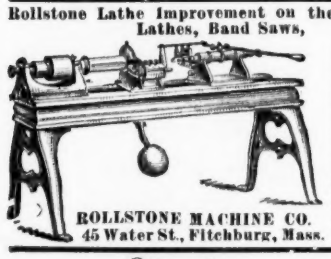

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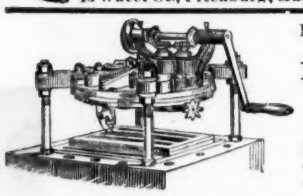

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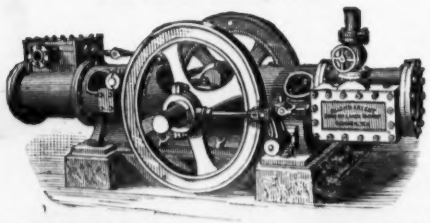

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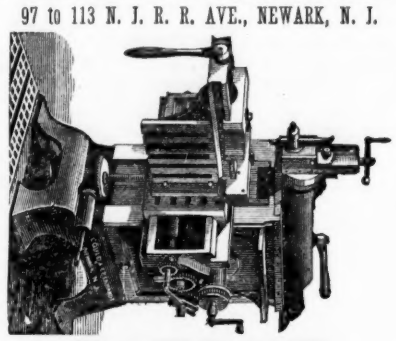

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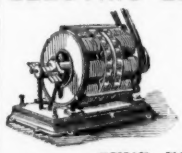

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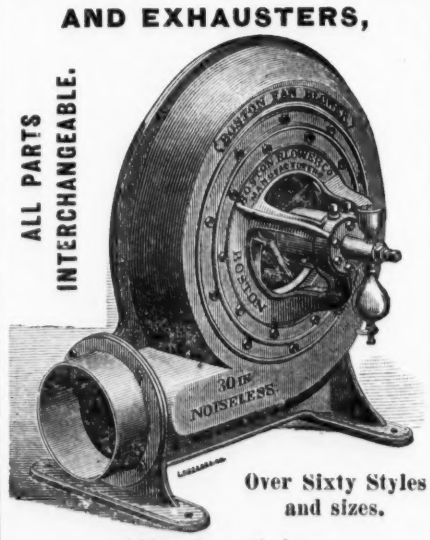


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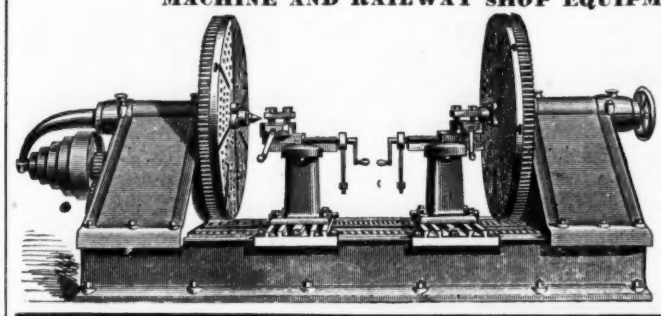

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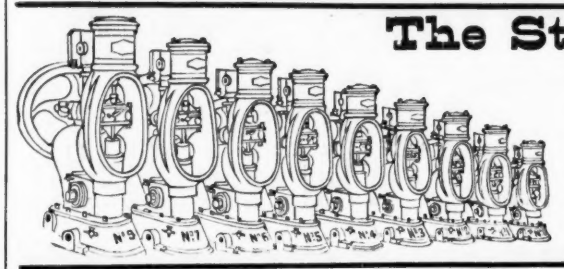

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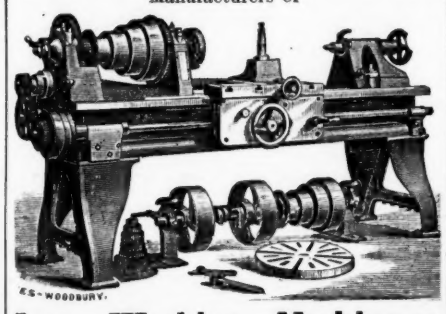

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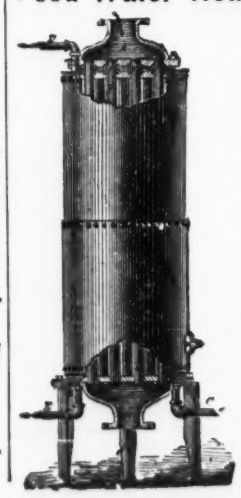

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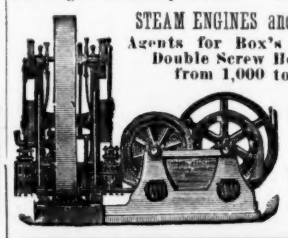

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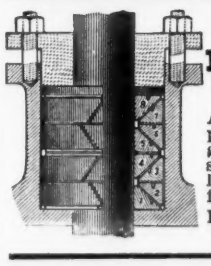

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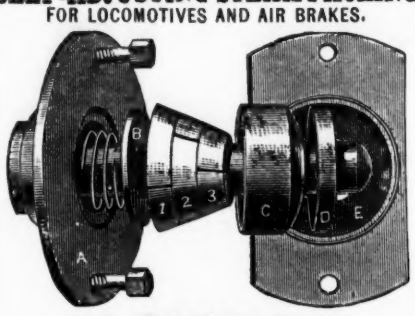

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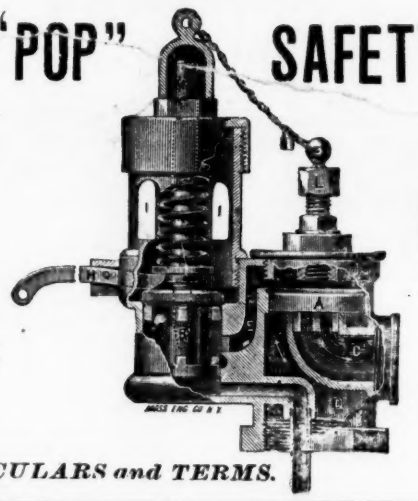

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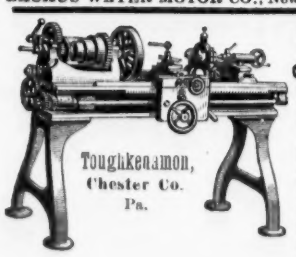

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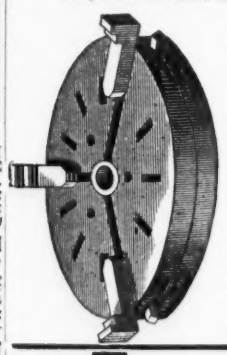

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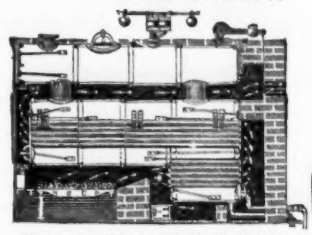

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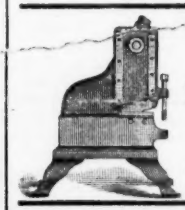

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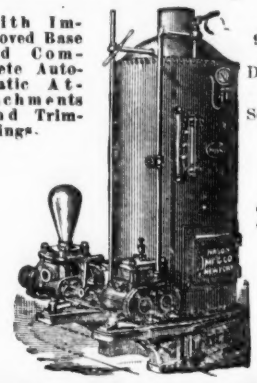

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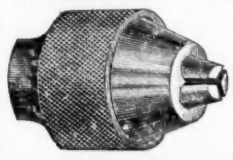

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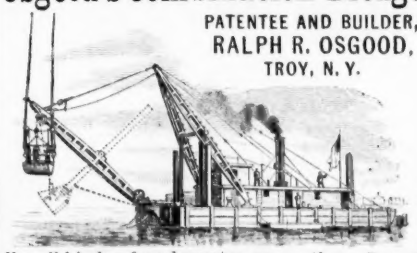

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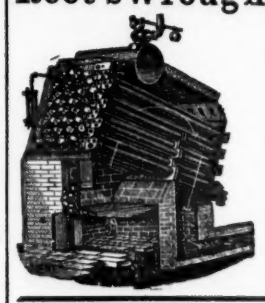

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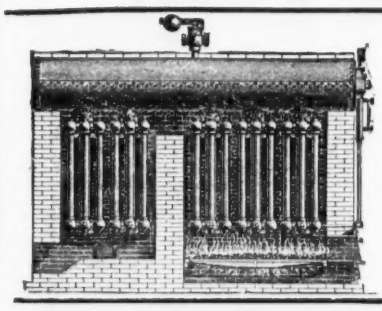

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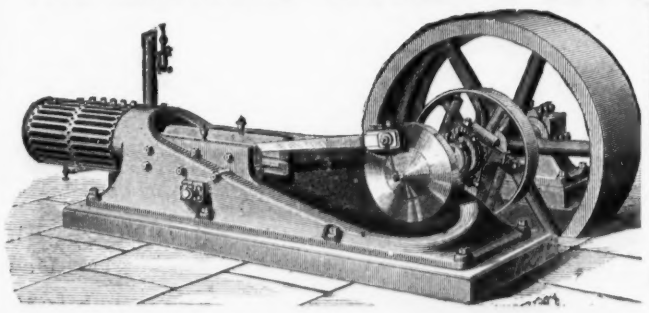

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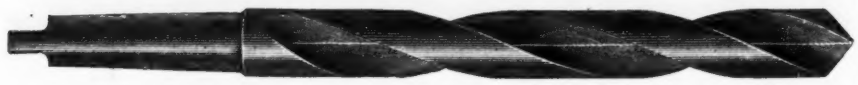

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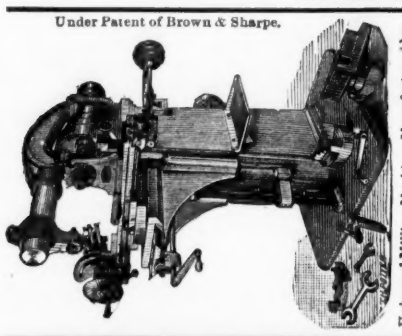

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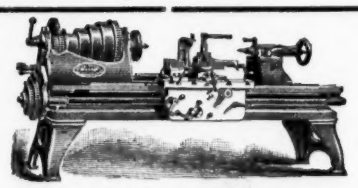

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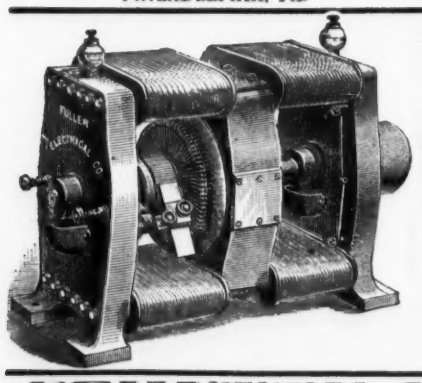

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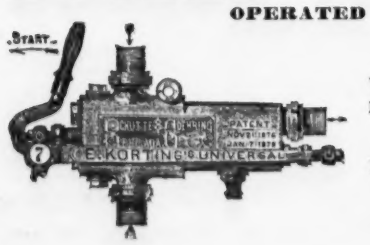


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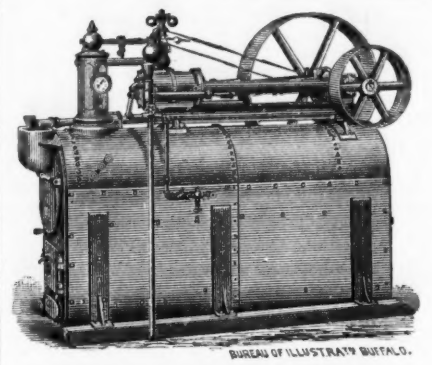

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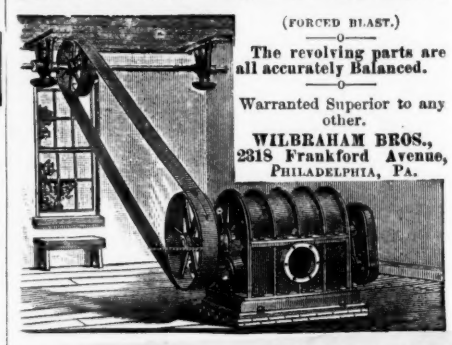

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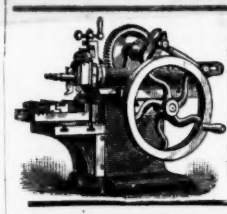

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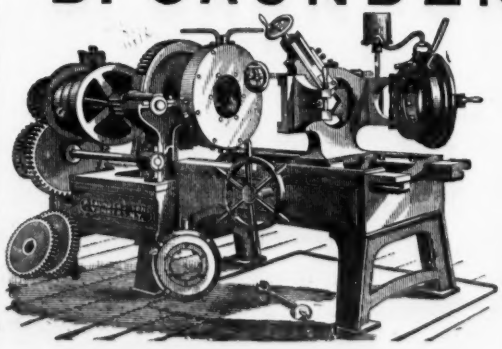

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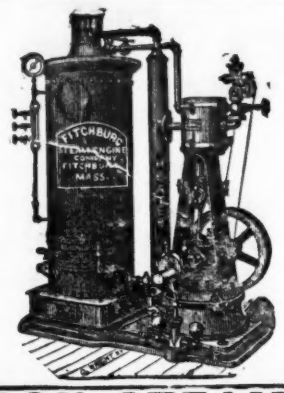


**STEEL AND IRON BOILERS.**

All sizes to 225 horse power.

Send for pamphlet and say where you saw this.

FITCHBURG STEAM ENGINE CO.
Fitchburg, Mass.

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**THE PORTER-ALLEN HIGH SPEED ENGINE.**

W. H. MERRICK, President and Treas.
G. A. BOSTWICK, Secretary.
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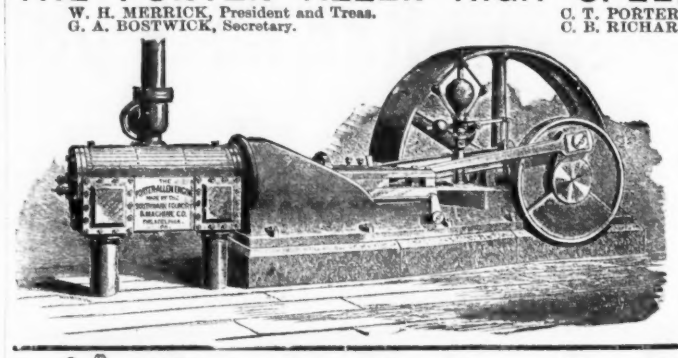

THE SOUTHWARK FOUNDRY & MACHINE CO., Philada., having largely increased its facilities is now prepared to fill all orders for the Porter-Aller Engine on contract time.

Orders solicited for Iron and Brass Castings in the rough.

Address the Company, 430 Washington Avenue, Phila., Pa.

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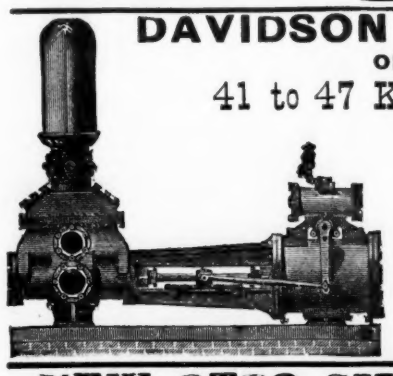
**DAVIDSON STEAM PUMP CO.**
OFFICE AND WORKS:
41 to 47 Keap Street, Brooklyn, N. Y.
MANUFACTURERS OF
THE M. T. DAVIDSON
**Improved Steam Pump.**



**Warranted the Best Pump Made for all Situations.**

KELLY & LUDWIG, Agents, 49 and 51 North 7th St., Phila., 97 Liberty St. New York.

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**F. E. REED,**
Successor to
A. F. PRENTICE & CO.
Manufacturer of
**Machinists' Tools.**

Improved Upright Drills, with Lever Feed, and Wheel Feed with Quick Return Motion.

ENGINE LATHES,
HAND LATHES,
SLIDE RESTS, and
PLANER CENTERS.

54 Hermon Street,
WORCESTER, MASS.

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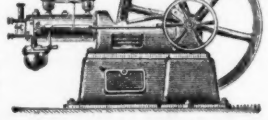
**NEW OTTO SILENT GAS ENGINE.**

Working without Boiler, Steam, Coal, Ashes or Attendance.

Started Instantly by a Match, it gives full power immediately.

When Stopped, all Expense Ceases.

No explosions; No Fires nor Cinders; No Gauges; No Pumps; No Engineer or other attendant while running.



Unsurpassed in every respect for Hoisting in Warehouses, Printing, Ventilating, Running small Shops, etc. 2, 4 and 7 H. P. and upwards.

Built by
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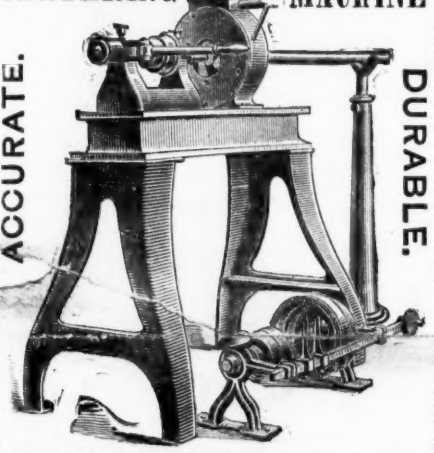
**A. F. HYDE'S PATENT CENTERING MACHINE**

ACCURATE. DURABLE.



Manufactured by WARREN HASKELL & CO.,
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**W. C. YOUNG & CO.,** Worcester, Mass.
Manufacturers of
ENGINE LATHES, HAND LATHES,
Foot Power Lathes, Slide Rests, &c.

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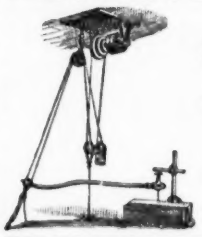
**THE STOW FLEXIBLE SHAFT**
OPERATING
**PORTABLE TOOLS**
FOR
Drilling, Tapping, Reaming, Polishing, &c.
Manufactured by
STOW FLEXIBLE SHAFT CO.
Limited.
1505 Penna. Ave., Philadelphia.



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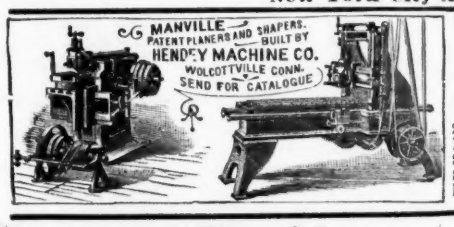


**The Hendey Machine Co.**
*TORRINGTON, CONN., U. S. A.*
Manville Patent Iron Planers and Shapers.

15 in. Shapers, 24 in. Shapers, 3½ ft. x 16 in., 5 ft. x 20 in., 6 ft. x 24 in., 8 ft. x 24 in. Planers, Amateurs' Hand Planers, with chuck and centers, Hollow Steel Spindle Hand Lathes, Brass and Wire Slitters, Spring Chuck, and Common Clock Lathes. Catalogue gives many names of users of our tools.

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VANDERBURGH, WELLS & CO.
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**MECHANICAL DRAWINGS,**
Designs, Tracings and Patent Office Work executed with despatch. **WOOD & RICHMOND,** Mechanical Engineers and Draughtsmen, 176 Broadway, New York.

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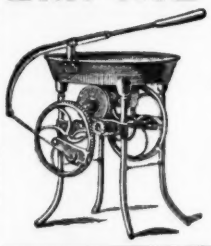

Improved, without Belts, Bellows, Crank Pins, Dead Centers or Back Motion.
Send for circular.

**EMPIRE**
Portable Forge Co.
COHOES, N. Y.

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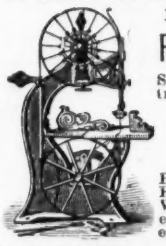
**J. A. FAY & CO.,** CINCINNATI, Ohio, U. S. A.
BUILDERS OF IMPROVED
**Wood-Working Machinery.**



Embracing nearly 400 Machines for
Planing & Matching,
Surfacing, Moulding, Tenoning, Mortising, Boring, and Shaping, &c.
Variety and Universal
**WOOD WORKERS.**
Band, Scroll and Circular Saws, Resawing Machines, Spoke and Wheel Machinery, Shafting, Pulleys, etc. All of the highest standard of excellence.

W. H. DOANE, Pres't. D. L. LYON, Sec'y.

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OFFICE AND WORKS:
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AND
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VALVES—Double and Single Gate, 1-2 in. to 48 in. outside and inside Screws, Indicator, etc., for Gas, Water and Steam.

Also,
FIRE HYDRANTS.
SEND FOR CIRCULAR.

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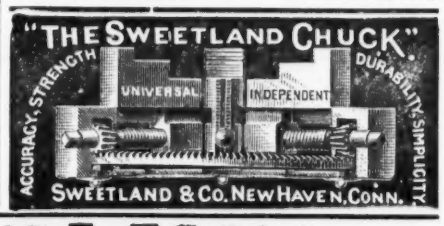
**"THE SWEETLAND CHUCK"**

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**Second-Hand & New MACHINERY.**

DECEMBER 21, 1881.

Two Car Axle Lathes, Hewes & Phillips. New.
One Hor. Boring Lathe, 52 in. x 13 ft. L. W. Pond. In good order.

| | | | |
|---|---|---|---|
| One Engine Lathe, | 36 in. x 15½ ft. | A1 order. | |
| One " | " | 30 in. x 15½ ft. | New Haven. |
| One " | " | 28 in. x 16 ft. | Fifield. New. |
| One " | " | 28 in. x 12 ft. | " " |
| One " | " | 24 in. x 12 ft. | Ames. New. |
| One " | " | 24 in. x 10 ft. | New Haven. |
| One " | " | 20 in. x 14 ft. | Fifield. New. |
| One " | " | 20 in. x 12 ft. | Harrington. A1. |
| One " | " | 20 in. x 10 ft. | Pond. A1. |
| One " | " | 20 in. x 10 ft. | Fifield. New. |
| One " | " | 20 in. x 8 ft. | Ames. New. |
| One " | " | 18 in. x 10 ft. | Jones & Lamson, New. 1⅝ in. Hole in Spindle. |

Three Engine Lathes 18 in. x 8 ft. Jones & Lamson New.
One Engine Lathe, 18 in. x 8 ft. Michael. Good order.
One Engine Lathe, 18 in. x 8 ft. Lathe & Morse. Good order.
One Engine Lathe, 16 in. x 6-7-8 ft. Bridgeport Mch. Tool Works. New.
Six Engine Lathes, 16 in. x 6 ft.-7ft. x 8 ft. Ames. New.
One " " 15 ft. x 8 ft. Pratt & Whitney.
One " " 15 in. x 6 ft. Flather's. New.
One " " 15 in. x 5 ft. Jones & Lamson. New.
Three " " 14 in. x 6 ft. Star Tool Co. New
One " " 14 in. x 6 ft. Hand. New.
One " " 13 in. x 6 ft. Ames. New.
One " " 13 ft. x 4½ ft.
Two " " 11 in. x 5 ft.
One Hand Lathe, 11 in. x 4½ ft. New Spencer.
Two " " 7 in. x 2¼ ft. " "
One Planer, 15 in. x 3 ft. Snow. Good order.
One " 18 in. x 42 in. Good order.
One " 22 in. x 5 ft. Hendey. New.
One " 24 in. x 6 ft. Hendey. New.
One Crank Planer, 12 in. stroke. A1 order.
One 6 in. Stroke Shaper. Boynton. New.
One 20 inch Stroke Shaper. Gould & Eberhardt. New.
One 24 in. Hendey Shaper, A1. order.
One 16 in. Upright Drill. Prentice. New.
Two 20 in. " " Prentiss. New.
One 22 in. " " Back Geared & L. F. Prentiss. New.
One 24 in. " " Ames. New.
One 29 in. " " Prentice. New.
Taree Sensitive Drills.
One Lincoln Miller. Pratt & Whitney. No. 2.
55 Lincoln Millers and Vises. Good order.
One No. 3 Garvin Hand Miller. New.
One 1000 lb Steam Hammer. Sweet.
One 10 in. x 30 in. Dudgeon Steam Hammer.
One 250 lb. Steam Hammer. Ferris & Miles.
One 200 lb. Bradley Hammer. A1.

E. P Bullard, 14 Dey Street, New York.
General Eastern Agent for
AKRON IRON CO'S Patent Hot Polished SHAFTING

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**NEW MACHINE TOOLS.**

On Hand Ready for Immediate Delivery.

| | | | | | |
|---|---|---|---|---|---|
| 15 inch swing, | | 6 feet bed, | Reed Screw Cutting Engine Lathe. | | |
| 15 " | " | 6 " | " | Flather | " |
| 16 " | " | 7 " | " | Wheeler | " |
| 18 " | " | 8 " | " | Wight & Powell Screw Cutting Engine Lathe. | |
| 18 " | " | 10 " | " | " | " |
| 18 " | " | 10 " | " | Blaisdell | " |
| 20 " | " | 12 " | " | Ames Mfg. Co. | " |
| 22 " | " | 14 " | " | " | " |
| 24 " | " | 12 " | " | " | " |
| 24 " | " | 12 " | " | Putnam Machine Co. | " |
| 26 " | " | 16 " | " | Niles Tool Works | " |
| 30 " | " | 15 " | " | Ames Mfg. Co. | " |
| 30 " | " | 23 " | " | " | " |

Gleason Iron Planer, 36 in. x 36 in. x 12 ft. with two heads.
Upright Drills, Radial Drills, Shapers and Bolt Cutters.

**HILL, CLARKE & CO.**
36 and 38 OLIVER STREET, BOSTON.

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**Second-Hand and New Machinery.**

**December 22, 1881.**

The following New and Improved Machinists Tools are part of what we have for early delivery:

| | | | | |
|---|---|---|---|---|
| 6 | 22 in. swing, | 12 ft. | Bed Engine Lathes. | December. |
| 1 | 22 in. " | 13½ ft. | " " | " |
| 3 | 18 in. " | 10 ft. | " " | " |
| 3 | 18 in. " | 8 ft. | " " | " |
| 2 | 15 in. " | 6 ft. | " " | " |
| 2 | 30 in. " | Upright Back Geared Drills | | " |

The following in store:

| | | | | |
|---|---|---|---|---|
| 1 | 21 in. swing, | 8 ft. | Bed Engine Lathe. | 2d-hand |
| 1 | 19 in. " | 6 ft. | " " | " |
| 2 | 18 in. " | 10 ft. | " " | New. |
| 2 | 18 in. " | 8 ft. | " " | " |
| 6 | 16 in. " | 6 ft. | " " | " |
| 1 | 17 in. " | 6 ft. | " " | 2d-hand. |
| 1 | 15 in. " | 5 ft. | " " | " |
| 1 | 12 in. " | 4 ft. | " " | " |
| 1 | 21 in. " | 10 ft. | Bed Turret Head Lathe. | |
| 1 | 15 in. " | 5 ft. | Bed Hand Lathe. | 2d-hand. |
| 3 | 12 in. " | 6 ft. | " " | New. |
| 1 | 10 in. " | 4½ ft. | " " | " |
| 1 | 9 in. " | 3 ft. | " " | " |

1 38 in swing Pulley Lathe, new.
1 Round Arbor Fox Lathe.
1 Iron Planer, 54 in. wide, 24 ft. long, with two heads, 2d-hand.
1 36 in. x 36 in. x 9 ft. Betts Planer. New.
1 12 in. x 12 in. x 2 ft. Planer. Hand or Power.
2 15 in. Hendey Shapers. New.
2 48 in. Swing Rad al Drills. New.
1 36 in. Car Wheel Borer. Nearly new.
1 21 in. Upright Drill. Nearly New.
2 24 in. Harris Upright Drills. Second-hand.
2 Wall Drills, heavy. Second-hand. 60 and 72 in
1 3 Spindle Drill. New.
1 Pratt & Whitney Cam Cutter, 2 heads. Fine.
1 Newton Milling Machine. New.
2 Milling Machines, Lincoln pattern. Second-hand
2 Manhattan Arms Co. Millers. Second-hand.
1 Sellers Milling Machine. 2d-hand.
1 Face Milling Machine. Second-hand.
1 Pond's Double Milling Machine. 2d-hand.
1 Garvin " " "
1 Screw Head Slotter. Second-hand.
3 Second-hand Profiling Machines.
1 Vertical Centering Machine. Nearly new.
3 4½ in. Horizontal Centering Machines. New.
3 Emery Grinders. 2d-hand.
1 Sellers' Tool Grinder. "
1 Pipe Cutting Machine. Second Hand. 2 in.
1 Bolt Cutter, 1½ in. New. With Taps and Dies
1 Bolt Pointing Machine. Second-hand.
3 Pulley Forcing Machines. Second-hand.
1 Horizontal Boring Bar, 12¾ in. diam. " "
1 " " Machine, Small. 2d-hand.
1 " " " 4 spindle "
1 Betts, No. 2, Power Punch. New.
4 Double-Acting Presses, No. 3, nearly new.
4 Single-Acting Presses, for power, "
100 Foot Presses, nearly new.
1 Medium Power Punching Press. Second hand.
2 Small " " Presses. "
1 Foot Punch, with bench. New.
1 Lot Pistol Machinery. Second hand.
2 Grind Stones and Frames Second-hand.
1 Crane. Second-hand. 20 ft. jib. 6 Tons.
Lot of Forges, 1 Jig Saw, 1 Double Saw Bench, 1 Band Saw, 1 Slat Tenoner, 1 Railway Saw Bench, 1 Foot-power Circular Saw
Cold Rolled Shafting, Pulleys, Hangers, Couplings, &c., always in store.

The George Place Machinery Agency,
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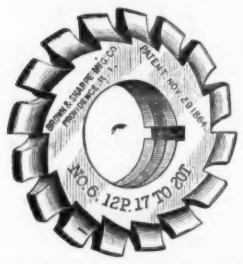
# BROWN & SHARPE MFG. CO.

**Providence, R. I.,**

## Manufacturers of Machinery and Tools.



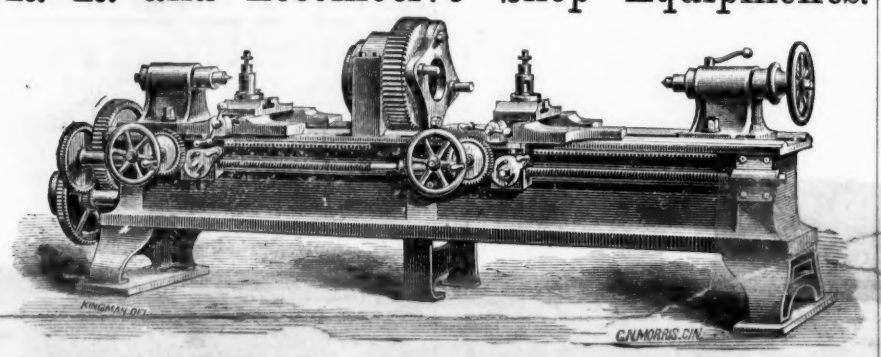

**Gears Cut & Index Plates Made & Drilled to Order.**

**Patent Cutters for the Teeth of Gear Wheels,**

can be sharpened by grinding without changing their form. Cutters made on this plan will outlast many of the old form, with the advantage of being always ready for use. If the cutter becomes dull before a wheel is completed, it can be taken out, sharpened and returned to its place in a few moments without risk of altering the form of teeth to be cut. Cutters for milling any irregular form made to order on the same plan. Parties having occasion to use mills for irregular shapes on sewing-machine, gun or other work, will readily see the advantage such cutters possess over those in general use, both as regards economy and convenience. Descriptive circular with price list sent by mail on application.

# CAR WHEEL AND AXLE MACHINERY,

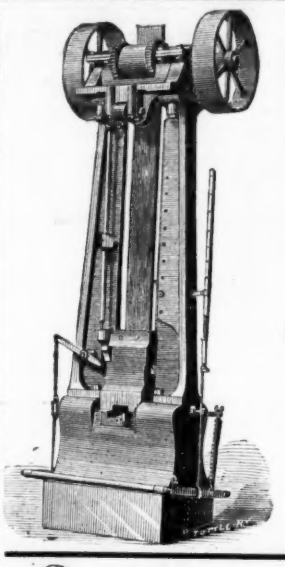
## R. R. and Locomotive Shop Equipments.




## DOUBLE AXLE LATHE.

# NILES TOOL WORKS,

**HAMILTON, OHIO.**



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**HARTFORD, CONN., U. S. A.**

Manufacturers of

## MACHINISTS' TOOLS

Gun, and Sewing Machine Machinery.

## DROP, & TILT HAMMERS,

**POWER, HAND AND FOOT**

## PUNCHING PRESSES,

**Broaching and Drawing Presses,**

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## Lathe Dogs.

We make these Dogs in 12 sizes, running from ⅜ to 4 inches. We guarantee the three smaller sizes to be forged of Bar Steel, and the nine larger sizes of Norway Iron. Any intelligent mechanic can well understand that a Dog forged of Machinery Steel or Norway Iron is a better article than a Cast Malleable Iron or Cast Steel Dog. Our prices are but a trifle higher than the Cast Dogs, and from the fact that we have not been able to supply the growing demand for them, convinces us that our goods are appreciated. Send for illustrated catalogue and price list.

# GRANT & BOGERT,

**JOHN J. GRANT.** **JOHN L. BOGERT.**

The above firm have recently established

# MACHINE TOOL WORKS

**At FLUSHING, L. I.**

It is their determination to send out only first-class machinery. They are striving to put on the market tools equal in material, design and workmanship to the best ever offered to the public. They have patterns in hand for a

## 22 INCH LATHE,

which is **EXTRA POWERFUL** and has **SEVERAL NEW IMPROVEMENTS.** Orders solicited for delivery in March, 1882.

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New descriptive Circular just out.

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MANUFACTURER OF

**Presses, Dies,**

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FOR SHEET METALS.

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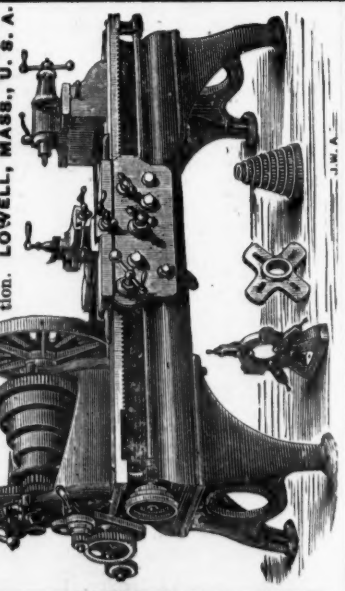

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For the manufacture of all kinds of Sheet Metal Goods, Drop Forgings, &c.

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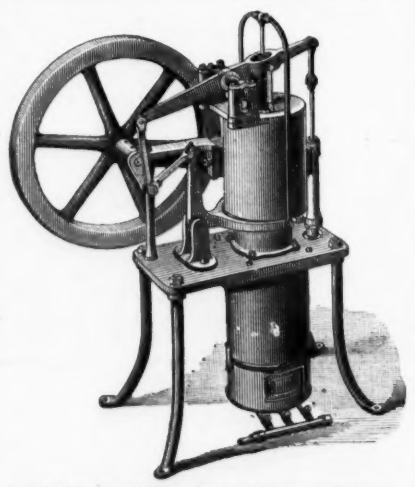

**ERICSSON'S CALORIC PUMP,**

C. H. DELAMATER & CO., 10 Cortlandt St., New York

**GEO. B. GRANT, ALDEN ST. BOSTON.** Special attention paid to orders by mail.

**GEAR CUTTING**

Gear wheels of all kinds and sizes, in iron or brass, for all purposes. On hand and to order. Send for new pamphlet.

## GEO. H. BARRUS, Expert Steam Engineer,

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## HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

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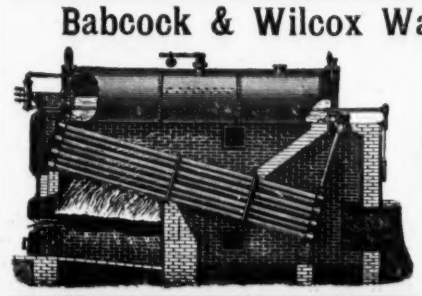
W. B. FRANKLIN, VICE-PRESIDENT.

J. B. PIERCE, SECRETARY.

## Babcock & Wilcox Water-tube Steam Boilers.

**Adapted for all Purposes. Safe from Explosions.**



3,678 H. P. in use by SINGER MF'G CO., New York; 3,790 H. P. by HARRISON HAVEMEYER & CO., Philadelphia; 2,880 H. P. by DECASTRO & DONNER SUGAR REFINING CO., Brooklyn; 4,600 H. P. by AMERICAN GRAPE SUGAR CO., Buffalo; 1,350 H. P. by THE JESSUP & MOORE PAPER CO., Wilmington; 720 H. P. by RARITAN WOOLEN MILLS, New Jersey; 600 H. P. by STUDEBAKER BROS. MF'G CO., South Bend, Ind., and hundreds of others in all kinds of business, from 50 H. P. to 2,000 H. P. each.

Centennial Exposition Medal awarded this boiler for highest economy and efficiency on test.

Illustrated Circulars and other desired information promptly furnished.

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**30 Courtlandt Street, New York.**

## Emery Wheels & Grinding Machines.

# THE TANITE CO.

Stroudsburg, Monroe County, Pa.

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Indianapolis, Corner Maryland and Delaware Sts.
New Orleans, 61 St. Charles St.
San Francisco, 2 and 4 California St.
Philadelphia, 925 Market St.
Boston, 21 Doane St.
Portland, Oregon, 43 Front St.
London, 9 St. Andrews St., Holborn Viaduct, E. C.
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# THE BUFFALO STEEL FOUNDRY, BUFFALO, N. Y.

**PRATT & LETCHWORTH, Proprietors.**

**Orders and Correspondence Solicited.**

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